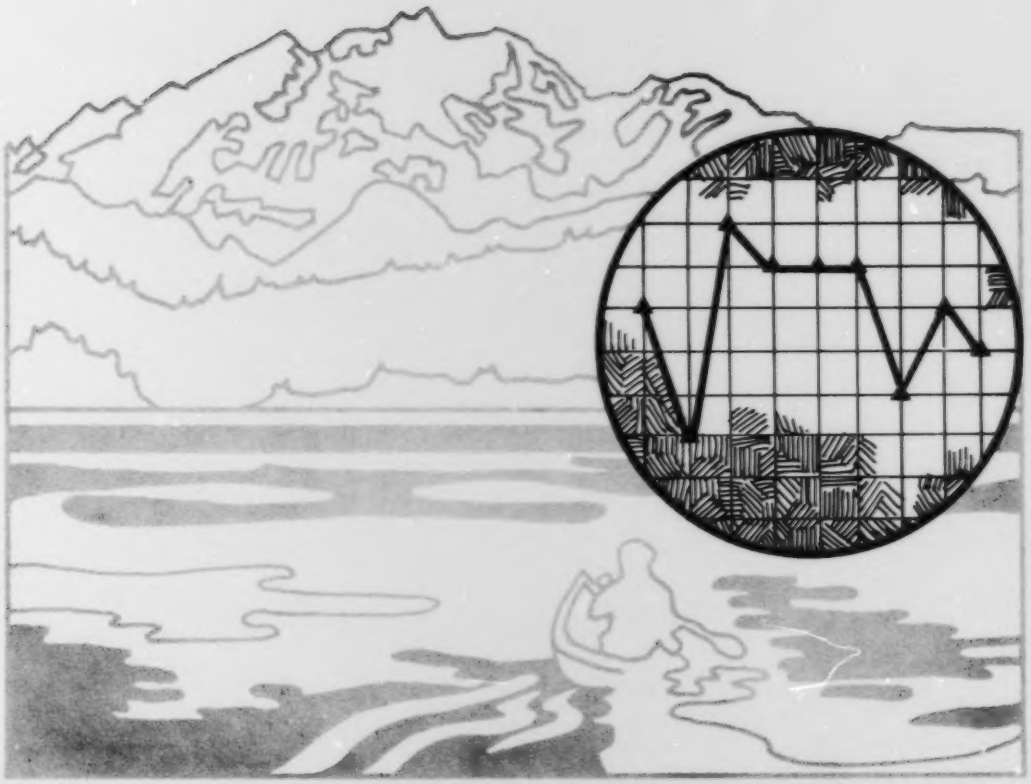
A Trend Study of Water Quality in British Columbia



Province of British Columbia
Ministry of Environment

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENVIRONMENT
WASTE MANAGEMENT BRANCH

A TREND STUDY OF WATER QUALITY IN BRITISH COLUMBIA

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ABSTRACT

The Ministry of Environment, Province of British Columbia has developed a province-wide network of water monitoring sites. This report presents the results of a recent study undertaken to ascertain whether long term changes in water quality had occurred at these sites and whether these changes had resulted in a positive or negative impact on the aquatic environment.

Ministry of Environment data for all river, lake, marine and estuarine sites were reviewed. Minimum selection criteria included at least seven years of data collected, 20 or more data values since January 1, 1978 and at least one value subsequent to January 1, 1980. Possible trends were then identified by intercomparison of half-portions by Student's t test comparison ($p < 0.01$). Each remaining trend was closely examined for possible sampling artifacts such as change in analytical methodology or seasonal sampling.

Finally, 114 trends at 28 sites were chosen as reflecting genuine changes in the aquatic environment. Of the 114 trends identified, 69 indicated an improvement to the environment, 31 indicated a degradation of the environment and, 14 most probably resulted in neither improvement nor damage to the environment.

The main environmental problems identified included an increase in copper and zinc levels in Buttle Lake, increased nutrient levels in Bailey Spring, the Elk River, Kalamalka Lake and St. Mary Lake, as well as an increase in tannin and lignins levels in the Kootenay River.

ACKNOWLEDGEMENTS

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1. INTRODUCTION

Over the past fifteen years the Ministry of Environment has been developing a network of water monitoring sites across British Columbia. Samples collected from these sites are forwarded to the Ministry's Environmental Laboratory in Vancouver for analysis, and the results are stored on the Ministry's computer system. As of December 7, 1983 data have been filed for 3204 river sites, 3093 lake sites, and 857 marine and estuarine sites for a total of 7154 sites. Each site has been sampled for a unique time frame, frequency and selection of variables -- depending on the indicated environmental concerns and other circumstances.

Through 1983, Ministry of Environment data for all river, lake, marine and estuarine sites have been reviewed to ascertain whether any long-term changes in water quality could be identified. Because of the work load and cost of the retrievals, seasonal effects could not be considered. (The Branch intends that they will be considered in a forthcoming project to be implemented after a new and less expensive computer system is implemented in 1984). Therefore, as a first step all data sets smaller than 20 values since January 1, 1978 were eliminated, as were data sets having no data collected after January 1, 1980, or having data collected for a time period shorter than seven years. Where data were collected at more than one depth, they were grouped into three depth ranges: 0-5 m, 5.1 - 25 m and >25 m. Those criteria yielded adequate data sets in total from 118 sites. As a second step, likely trends were identified by intercomparison of half-portions by Student's t test comparison ($p < 0.01$). Finally, each data set remaining was closely examined, and those trends which most likely resulted from a change in analytical methodology or change in seasonal sampling pattern were eliminated.

It should be noted that federal and industrial monitoring data stored on the Ministry's computer system were specifically excluded from this study.

Some 114 trends at 28 sites were chosen as statistically real and reflecting genuine changes in the aquatic environment. These trends are tabulated and any known causes are discussed in the following section. The site locations are shown on a map of the province, Figure 1, followed by graphical presentations of all the trend data.

Of the 114 trends identified, 69 indicated significant improvement to the environment, 31 indicated significant degradation of the environment, and 14 most likely resulted in neither improvement nor damage.

Several families of related environmental problems were identified. Most serious of these was the increase in copper and zinc levels in Buttle Lake. However, remedial measures implemented by Westmin Resources Limited under instruction from the Ministry are beginning to improve the situation, as can be seen on the respective plots. Nutrients are increasing at several locations in the province including Bailey Spring, the Elk River, Kalamalka Lake, and St. Mary Lake. For most of these sites, excessive biological growth might become a problem. St. Mary Lake is more serious however, since it shows signs of becoming more eutrophic. The tannin and lignins problem identified in the Kootenay River should have been improved by the installation of rapid infiltration effluent treatment in 1981 at CFI Skookumchuck. Finally, the increasing pH at a number of locations in the Kootenay River watershed warrants attention because the cause is not known.

A similar study had been carried out five years ago (Clark, 1978), though only key sites had been reviewed at that time, as opposed to all

surface water sites for the present study. This earlier study had found 61 trends at 14 surface water sites and also 83 trends at 25 air sites. It was of interest to ascertain how many of the previously found surface water trends were duplicated in this study. In fact, only 14 of 61 were repeated. This matter is discussed in further detail in Appendix 1. However, it appears that discontinuation of various sampling programmes has resulted in insufficient data to meet the minimum selection criteria for the current study at a number of locations of interest.

2. DISCUSSION

LOCATION	PARAMETERS	INTERPRETATION
1. Bailey Spring[1]		
a. Site 0500578, a spring of groundwater origin; streambed tributary to Kalamalka Lake	Dissolved Phosphate	The increasing levels of dissolved phosphate in Bailey Spring possibly have been carried by groundwater from Vernon's spray irrigation project. The Okanagan Regional office of the Waste Management Branch has further environmental studies underway in this area.
2. Buttle Lake		
a. Site 0130080, Buttle Lake near Bridge to Gold River (32 km from foot of lake)	Specific Conductivity[2] Total Copper Dissolved Zinc Total Zinc	The contamination of Buttle Lake by the Westmin Resources Ltd. Myra Creek operation near the southmost extreme of Buttle Lake is well documented (Clark 1980; Clark and Morrison, 1982).
b. Site 0130084, Buttle Lake at Narrows (7.5 km from foot of lake)	Total Zinc	Westmin Resources Ltd. is making considerable efforts to alleviate this problem, and there are preliminary signs that the lake is beginning to recover. The metal levels observed are sufficient to stress fish, but not to cause major fish kills.
3. Campbell River (Vancouver Island)		
a. Site 0120820, upstream of the confluence with the Quinsam River.	Specific Conductivity	The increased specific conductivity in the Campbell River most likely results from the Westmin Resources Ltd. mining operation beside Myra Creek, a tributary of Buttle Lake. This trend is somewhat more distinct in the corresponding plot for Buttle Lake.

Notes: 1. Except where otherwise specified, data for 0 to 5 m depth range is indicated.
2. Throughout this report Specific Conductivity refers solely to Laboratory measurements of Specific Conductivity, not to *in situ* measurements.

4.	Deep Creek, a tributary to Okanagan Lake		
	a. Site 0500020, at mouth of Creek	Specific Conductivity	The observed decrease in specific conductivity reflects an improvement in the water quality at this site. The reason for this improvement is not known.
5.	Elk River, a tributary to the Kootenay River		
	a. Site 0200027, upstream of confluence with Grave Creek	Nitrate + Nitrite	The increasing trend in nitrate plus nitrite since about 1975 has been attributed to residuals from use of slurry type nitrogen-based explosives at the Fording Coal Ltd. operation. More detailed information recently has been published regarding this problem (Crozier and McDonald, 1980; Pommen, 1983).
	b. Site 0200102, south of Sparwood	Nitrate + Nitrite	(as above)
	c. Site 0200024, at Hosmer	Ammonia	The Westar Coke plant began a partial recycle of effluent from the coke plant to the quenching towers in 1971. This improvement has resulted in reduced levels of ammonia in the environment.
	d. Site 0200111, near Natal	Nitrate + Nitrite	(as for site 0200027)

e. Site 0200016, at Philips Canyon	Lab pH Chloride Nitrate + Nitrite Organic Nitrogen Dissolved Potassium	The Kootenay Regional Office of the Waste Management Branch has identified an increased volume of sewage entering the Elk River since the mid-1970's. This probably contributes to the observed increase in chloride, nitrate and nitrite and organic nitrogen. Additionally, some chloride likely originates from the highway paralleling the Elk River, and the nitrate and nitrite levels have increased as discussed for site 0200027. The reason for the decreased levels of potassium and increased levels of pH are not known.
6. Eneas Creek, a tributary to Okanagan Lake.		
a. Site 0500324, near mouth of creek	Field pH	Eneas Creek is a small stream fed by a reservoir and also receiving groundwater input along its length. Its water quality potentially might be affected by non-point sources, especially orchards and a small cannery. The reason for the decreasing pH is not known, but the lower values indicate an improved water quality.
7. Fraser River		
a. Site 0300002, at Oak Street Bridge	Fecal Coliforms	The observed decrease in fecal coliforms is believed to reflect the diversion of upstream sanitary sewers to the Annacis Sewage Treatment Plant.
8. Kalamalka Lake		
a. Site 0500581, Kalamalka Lake in Bay at mouth of Bailey Creek (Site A)	Field pH Dissolved Phosphate Total Phosphate	Site 0500581 is situated where return flow from the spray irrigation project would enter Kalamalka Lake, whereas site 0500580 would not be directly influenced by the spray irrigation.

b. Site 0500580, west shore of Kalamalka Lake in first bay south of Vernon spray irrigation project (Site B)	Field pH Dissolved Phosphate Total Phosphate	Note the similarity between the two Kalamalka Lake sites for each of the parameters listed. The reasons for these changes are not known, but clearly both sites are similarily influenced. There is some debate as to the possible impact of the Vernon spray irrigation; also, it is possible that these changes are related to the natural marl cycle of this lake.
9. Kootenay Lake		
a. Site 0200031, at Kuskonook		
i. 0 to 5 m depth	Organic Carbon Chlorophyll a Ortho Phosphate Total Phosphate	The lowered phosphate levels reflect construction of the Cominco Kimberly gypsum ponds in 1968, impoundment of Libby Dam in 1972 and implementation of the Cominco Kimberley gypsum recycle in 1975. The 1975 recycle especially seems to have had an impact on the Kootenay River, Lake Koocanusa and Kootenay Lake. Note that little phosphate is now available even during overturn conditions. This in turn has reduced the productivity of Kootenay Lake as evidenced by the decrease in chlorophyll a. The change in alkalinity and organic carbon may also reflect this drop in productivity. The Kootenay Regional Office of the Waste Management Branch has reported that blooms of blue-green algae no longer occur in the lake, whereas such blooms were common in the early 1970's.
ii. 5.1 to 25 m depth	Chlorophyll a	
iii. depth greater than 25 m	Total Alkalinity Organic Carbon Dissolved Oxygen Ortho Phosphate Sulphate	

b.	Site 0200034, at Cape Horn		
i.	0 to 5 m depth	Organic Carbon Ortho Phosphate Total Phosphate	(as above)
ii.	5.1 to 25 m depth	Chlorophyll a	(as above)
iii.	depth greater than 25 m	Total Alkalinity Organic Carbon Dissolved Oxygen Ortho Phosphate Total Phosphate Sulphate	(as above)
c.	Site 0200057, at Kaslo		
i.	0 to 5 m depth	Lab pH Organic Carbon Ortho Phosphate	(as above)
ii.	5.1 to 25 m depth	Chlorophyll a	(as above)
iii.	depth greater than 25 m	Total Alkalinity Organic Carbon Dissolved Magnesium Ortho Phosphate Total Phosphate Sulphate	(as above). The reason for the apparent increase in dissolved magnesium is not known.

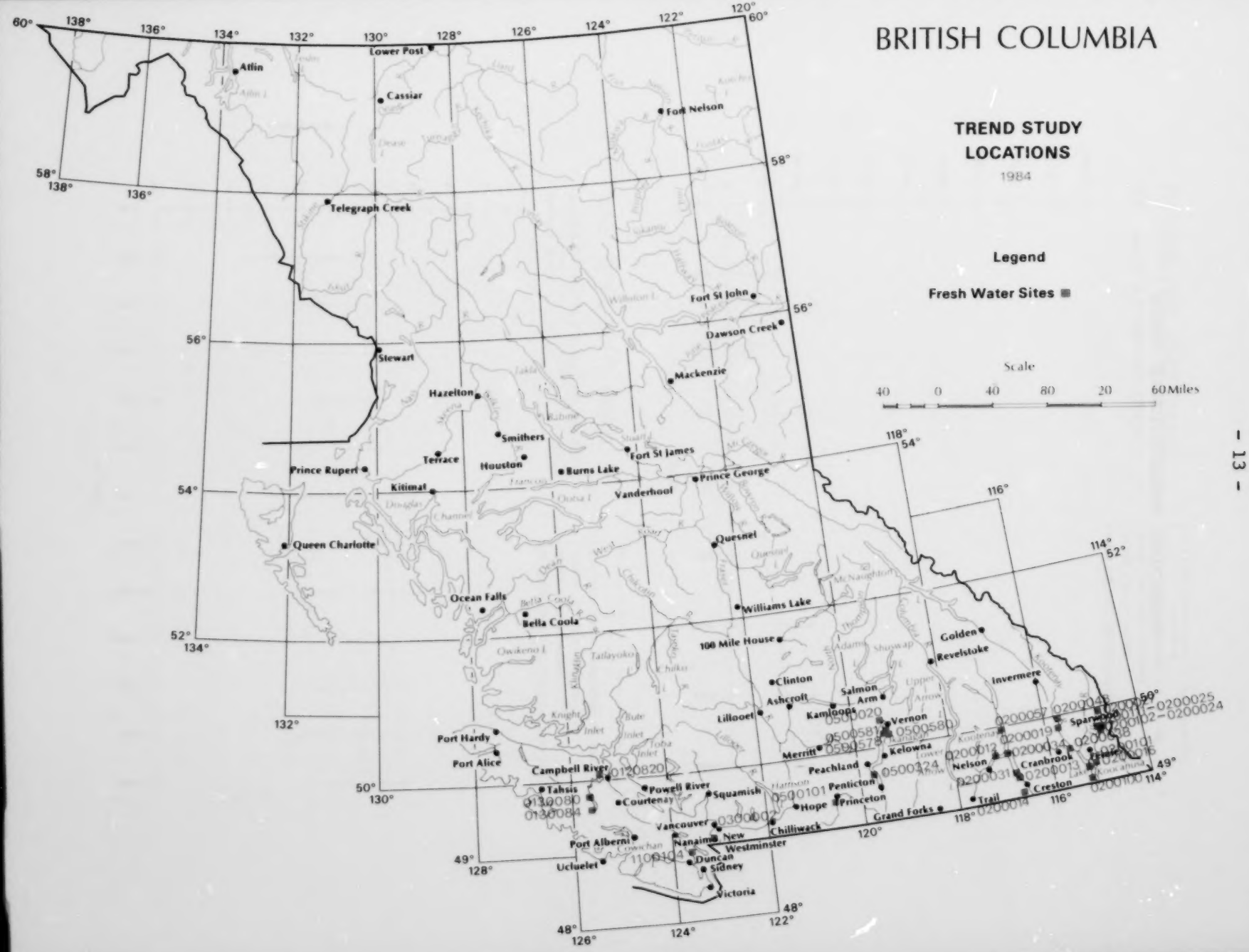
10. Kootenay River

a. Site 0200048, at Skookumchuck	Colour Tannin and Lignins	The increased levels of tannin and lignins and colour at both Skookumchuck and Wasa is believed to be due to the new pulp washing facilities installed at CFI Skookumchuck pulp mill early in 1977. However, these levels have been improved by the installation of rapid infiltration effluent treatment in 1981. The Waste Management Branch is discontinuing the use of tannin and lignins for environmental monitoring in favour of resin acids and colour measurements, which more accurately detect environmental problems associated with pulp mills. Note however that a new colour measurement methodology was initiated mid 1982. No explanation is known for the apparent decrease in ammonia levels at Wasa.
b. Site 0200019, at Wasa	Ammonia Colour Tannin and Lignins	
c. Site 0200038, at Picture Valley	Lab pH Ammonia Organic Carbon Fluoride Dissolved Manganese Ortho Phosphate Total Phosphate Dissolved Potassium Dissolved Zinc	The graphs show apparent decreases in ammonia, organic carbon, fluoride, dissolved manganese, ortho phosphate, total phosphate, dissolved potassium and dissolved zinc. All these decreases are associated with the implementaion of Cominco Kimberley's gypsum recylce in 1975. The reason for the increase in pH of the Kootenay River is not known.
d. Site 0200014, at Porthill	Field pH Ammonia Fluoride Ortho Phosphate Total Phosphate	The decrease in ammonia, fluoride, ortho phosphate and total phosphate is attributed both to the Libby impoundment in 1972 and to the Cominco Kimberley gypsum recycle in 1975. The reason for the increasing levels of pH is not known.

e. Site 0200013, near Creston	Field pH Lab pH Ammonia Fluoride Ortho Phosphate Total Phosphate	As for the upstream sites, the water quality at Creston has increased in pH and has decreased levels of ammonia, fluoride, ortho phosphate and total phosphate. Again the reason for the change in pH is not known; the Libby impoundment and Cominco Kimberley gypsum recycle jointly explain the lowered levels of ammonia, fluoride and phospate.
f. Site 0200012, near Fraser Rapids	Field pH Lab pH Organic Carbon Ortho Phosphate Total Phosphate	Again, no explanation is known for the increased pH; the decreased phosphate jointly results from the 1972 Libby impoundment and the 1975 Cominco Kimberley gypsum recycle. The lowered levels of organic carbon possibly may also be related to the Libby impoundment.
11. Lake Koocanusa		
a. Site 0200101, near confluence of Elk River		
i. 0 to 5 m depth	Ortho Phosphate Reactive Silica	Decreases in both silica and phosphate appear to pre-date the 1975 Cominco Kimberley gypsum recycle, and presumably reflect both construction of the Kimberley gypsum ponds in 1968 plus the impact of the Libby impoundment in 1972.
b. Site 0200100, at International Border		
i. 0 to 5 m depth	Organic Carbon Ortho Phosphate Total Phosphate	The lowered levels of organic carbon and phosphate (and ammonia for the deeper water) directly reflects the Cominco gypsum recycle initiated in 1975. Lower algal productivity because of the lower phosphate may also have contributed to the observed decrease in organic carbon.

ii. 5.1 to 25 m depth	Ammonia Organic Carbon Ortho Phosphate Total Phosphate	(as above)
iii. depth greater than 25 m	Ammonia Organic Carbon	(as above)
12. Michel Creek, a tributary to the Elk River		
a. Site 0200025, at Natal	Ammonia	The Westar Coke plant began a partial recycle of effluent from the coke plant to the quenching towers in 1971. This improvement has resulted in reduced levels of ammonia to Michel Creek.
13. St.Mary Lake, Saltspring Island		
a. Site 1100104, north end of lake		
i. 0 to 5 m depth	Total Alkalinity Inorganic Carbon Specific Conductivity Kjeldahl Nitrogen Dissolved Oxygen Total Phosphate	The water quality of St. Mary Lake recently was reviewed by Ministry scientists. (Nordin et al., 1983). They concluded that the water quality of St. Mary Lake had significantly changed over the past decade, the most important change being the increase in nutrients. The lake presently is eutrophic with year-round blooms of blue-green algae; oxygen is depleted in deeper waters (hypolimnion) of the lake.
ii. 5.1 to 25 m depth	Total Alkalinity Inorganic Carbon Specific Conductivity Nitrate + Nitrite Kjeldahl Nitrogen Total Nitrogen Dissolved Oxygen Ortho Phosphate Dissolved Phosphate Total Phosphate	It is believed that development of the area surrounding the lake increased the phosphate input, which in turn resulted in sufficient change in the water chemistry to the point that the lake sediments have now become a net source of phosphate. Lake restoration will require both artificial change to the lake chemistry and control of nutrients from land development and sewage disposal.

14. Wolfe Creek, a tributary of the Similkameen River		
a. Site 0500101, downstream of Newmont Mines tailing dam	Specific Conductivity	The increasing trend is statistically real, and most likely results from the Newmont Mines operation. However, the observed change in water chemistry is believed to have had little or no deliterious effects on fish or other aquatic life in the creek. The Okanagan Regional Office of the Waste Management Branch has further studies underway to this regard. It should be noted that there have been some environmental problems in the past associated with the Newmont Mines impact on Wolfe Creek. Newmont Mines had subsequently improved its reclaim system.


BRITISH COLUMBIA
TREND STUDY LOCATIONS
1984
Legend
Fresh Water Sites
Scale
40 0 40 80 120 60 Miles
Lower Post
Atlin
Cassiar
Fort Nelson
Telegraph Creek
Fort St John
Dawson Creek
Stewart
Mackenzie
Hazelton
Smithers
Terrace
Houston
Fort St James
Prince Rupert
Burns Lake
Prince George
Kitimat
Vanderhoof
Queen Charlotte
Quesnel
Ocean Falls
Williams Lake
Bella Coola
100 Mile House
Golden
Revelstoke
Clinton
Ashcroft
Salmon Arm
Invermere
Lillooet
Kamloops
Vernon
Sparwood
Port Hardy
Merritt
Kelowna
Port Alice
Campbell River
Peachland
Nelson
Cranbrook
Tahsis
Powell River
Squamish
Penticton
Courtenay
Hope
Princeton
Trail
Creston
Grand Forks
Vancouver
Chilliwack
Port Alberni
Nanaimo
New Westminster
Duncan
Ucluelet
Sidney
Victoria
0120820
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0300002
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0500576
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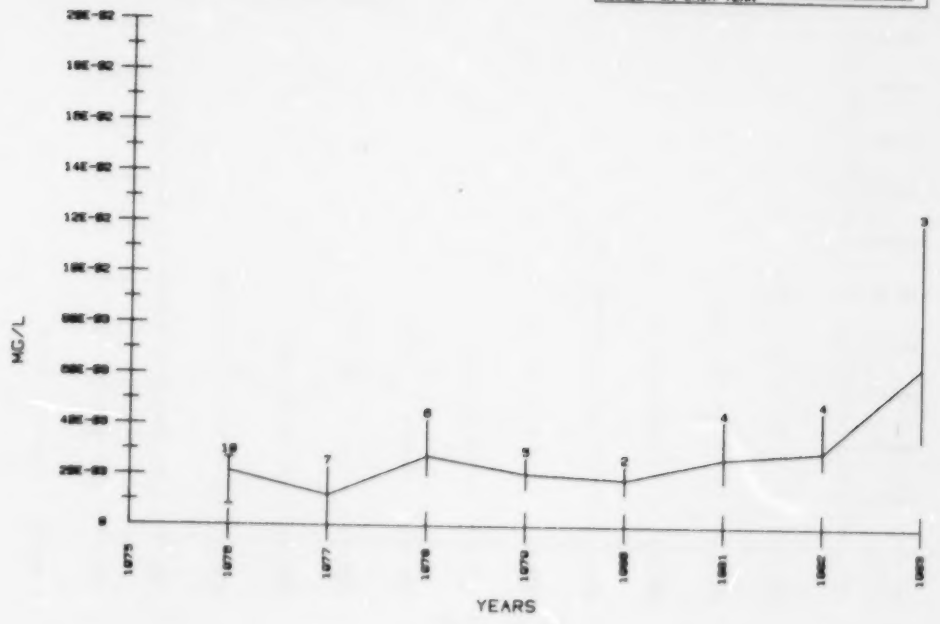
0200052
0200019
0200034
0200038
0200012
0200031
0200013
0200100
0200014
0200101
0200102-0200024
0200016
0200025
1100104
60° 58° 56° 54° 52° 50° 49° 48°
138° 136° 134° 132° 130° 128° 126° 124° 122° 120° 118° 116° 114°

4.GRAPHICAL PRESENTATION OF TRENDS

DISSOLVED PHOSPHATE

0500578: BAILEY SPRING-VERNON

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR

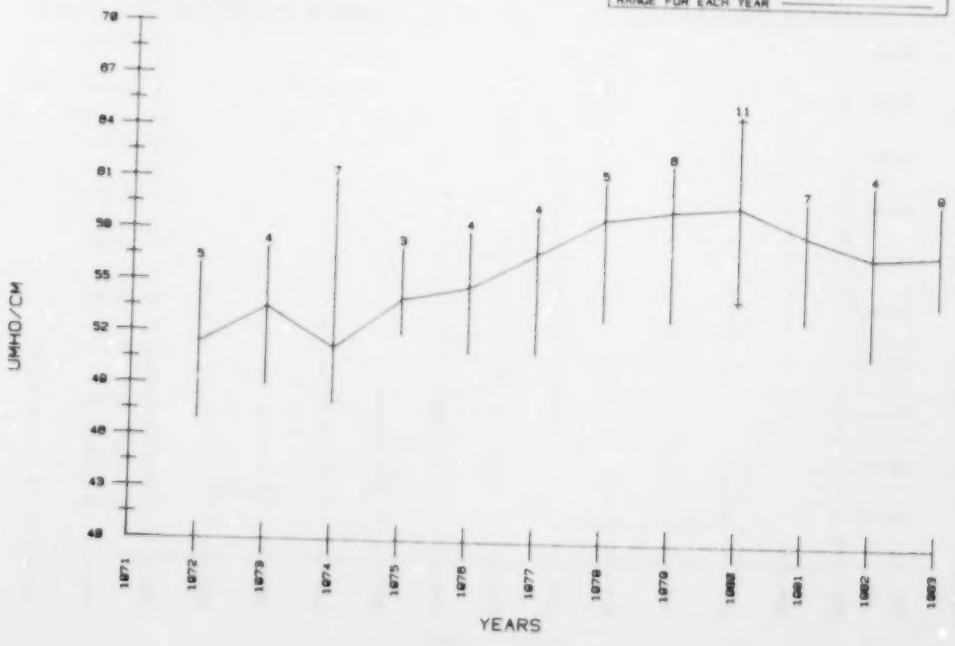


LAB SPECIFIC COND.

0130080: BUTTLE LAKE AT BRIDGE

DEPTH: 0 TO 5 M

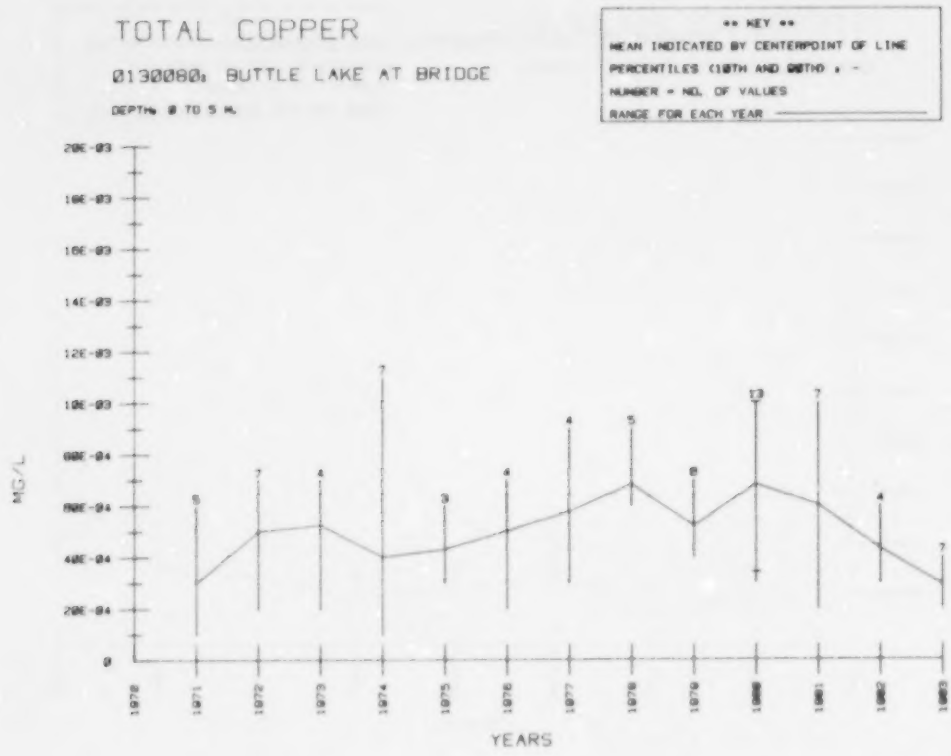
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR



TOTAL COPPER

0130080: BUTTLE LAKE AT BRIDGE

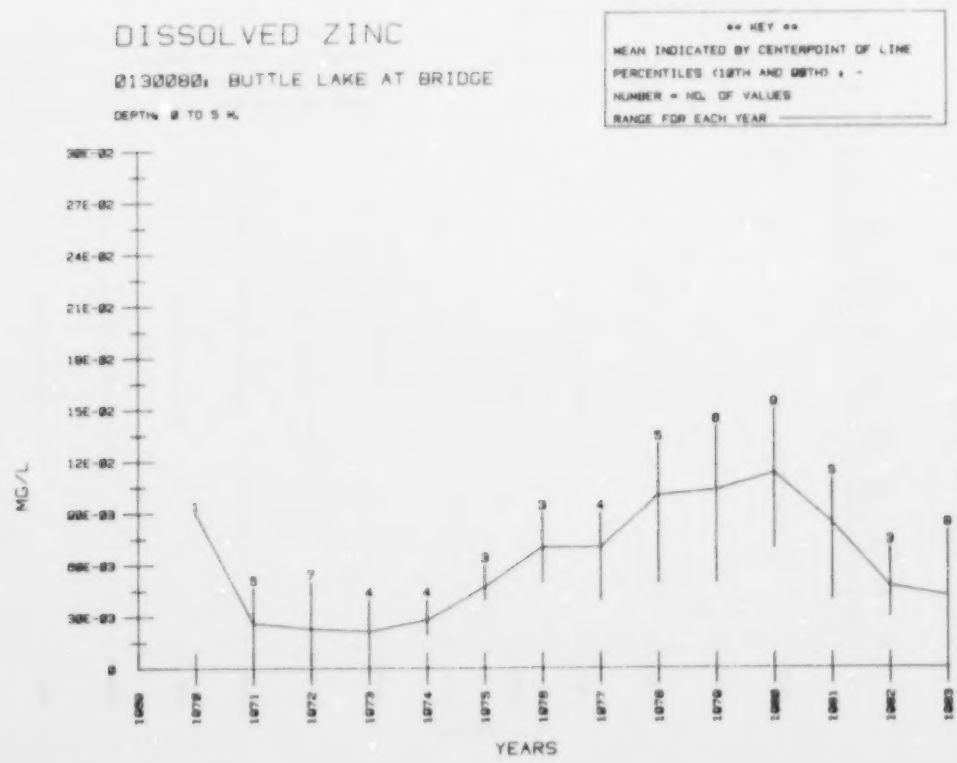
DEPTH: 0 TO 5 M.

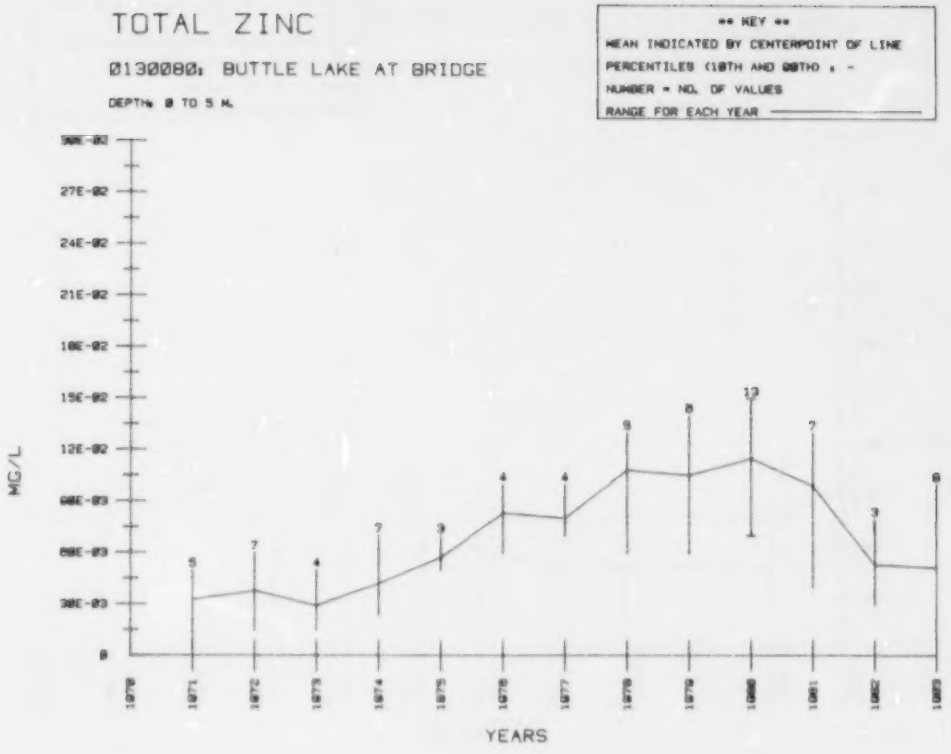


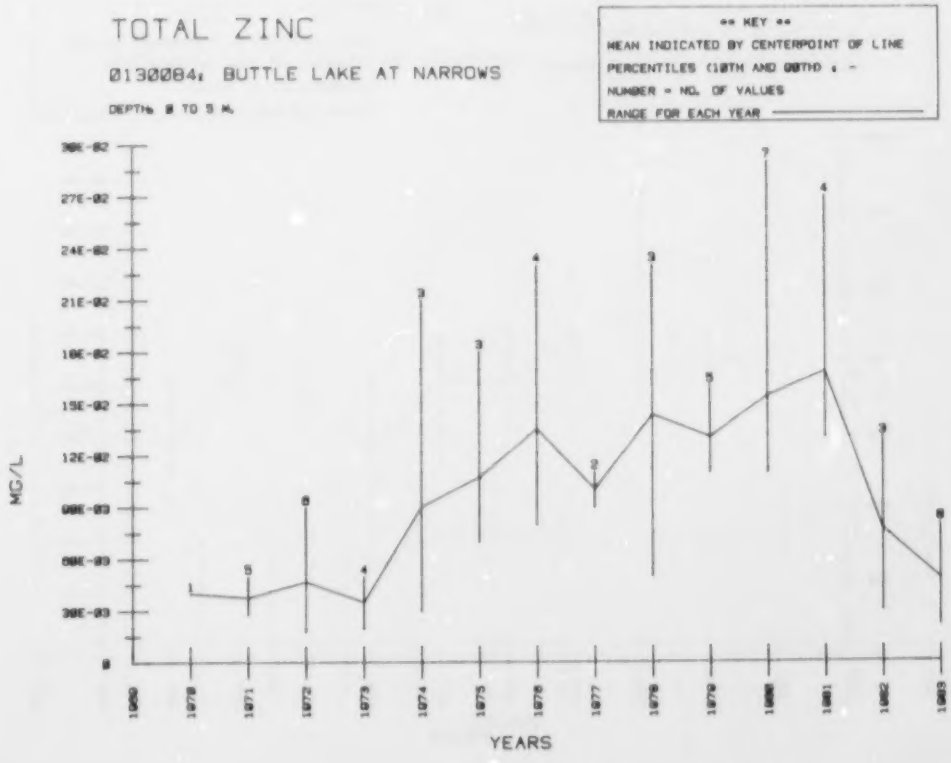
DISSOLVED ZINC

0130080: BUTTLE LAKE AT BRIDGE

DEPTH: 0 TO 5 M.

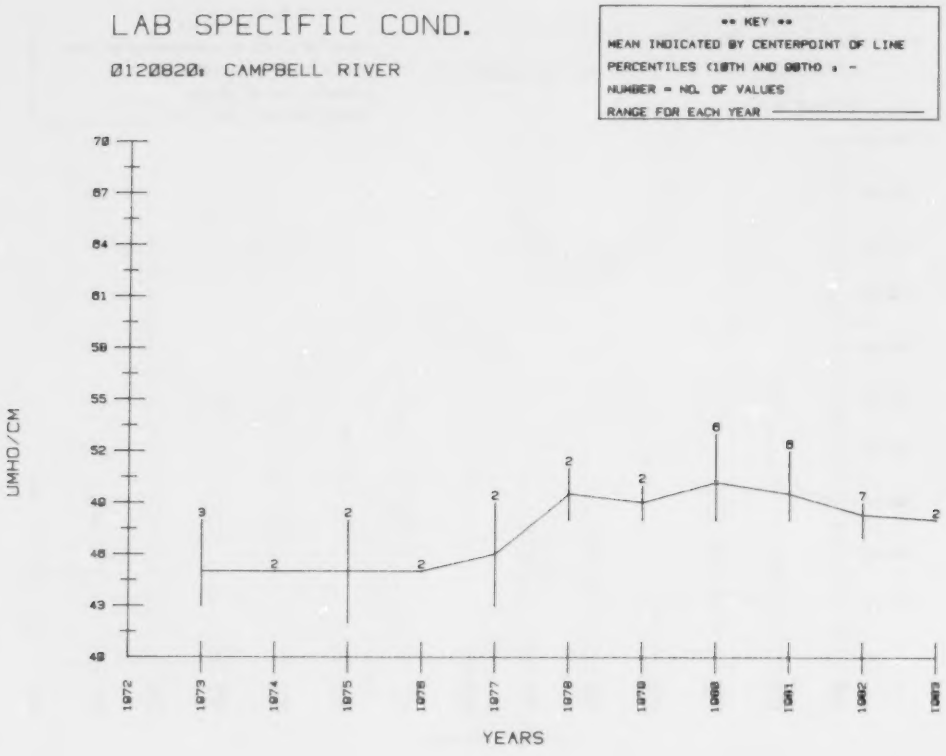



TOTAL ZINC
0130080: BUTTLE LAKE AT BRIDGE
DEPTH: 0 TO 5 M.
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR
MG/L
YEARS


TOTAL ZINC
0130084: BUTTLE LAKE AT NARROWS
DEPTH: 0 TO 5 M.
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR
MG/L
YEARS

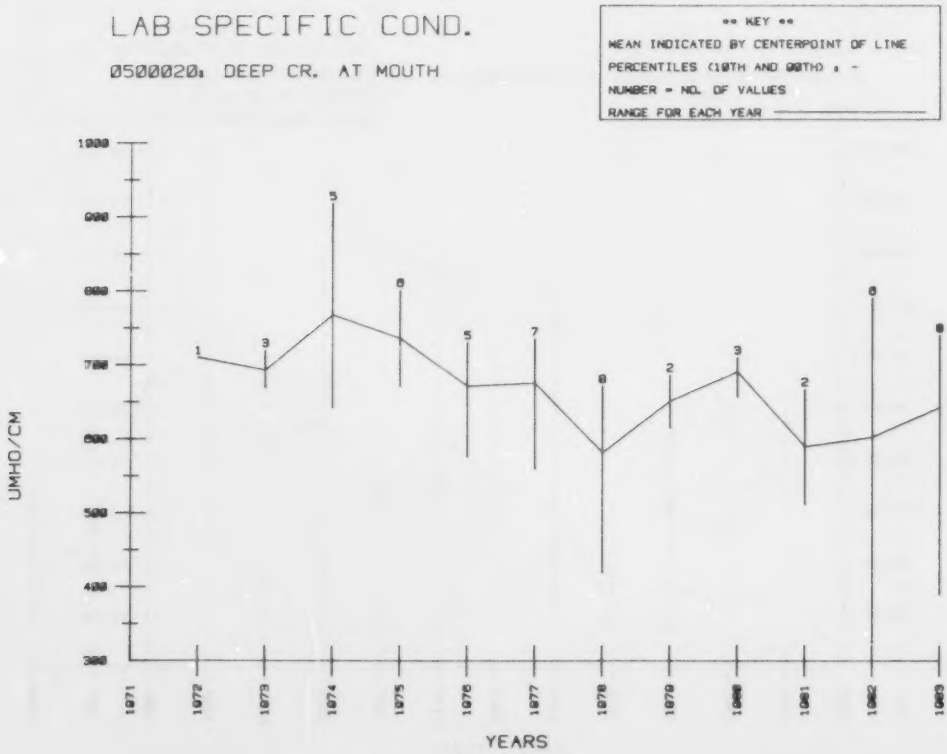
LAB SPECIFIC COND.

0120820: CAMPBELL RIVER



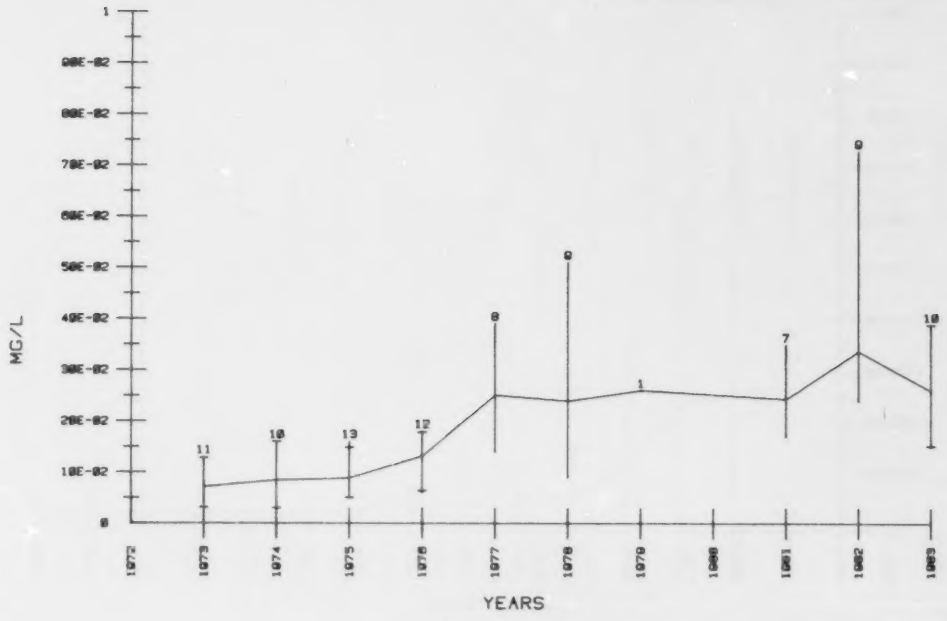
LAB SPECIFIC COND.

0500020: DEEP CR. AT MOUTH



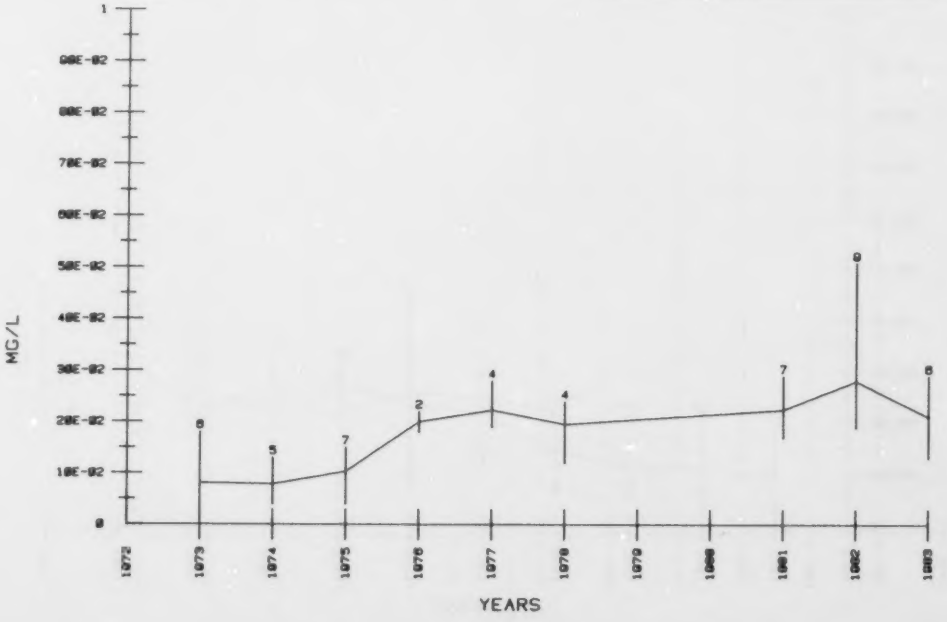
NITRATE + NITRITE

0200027: ELK R. U/S GRAVE CR



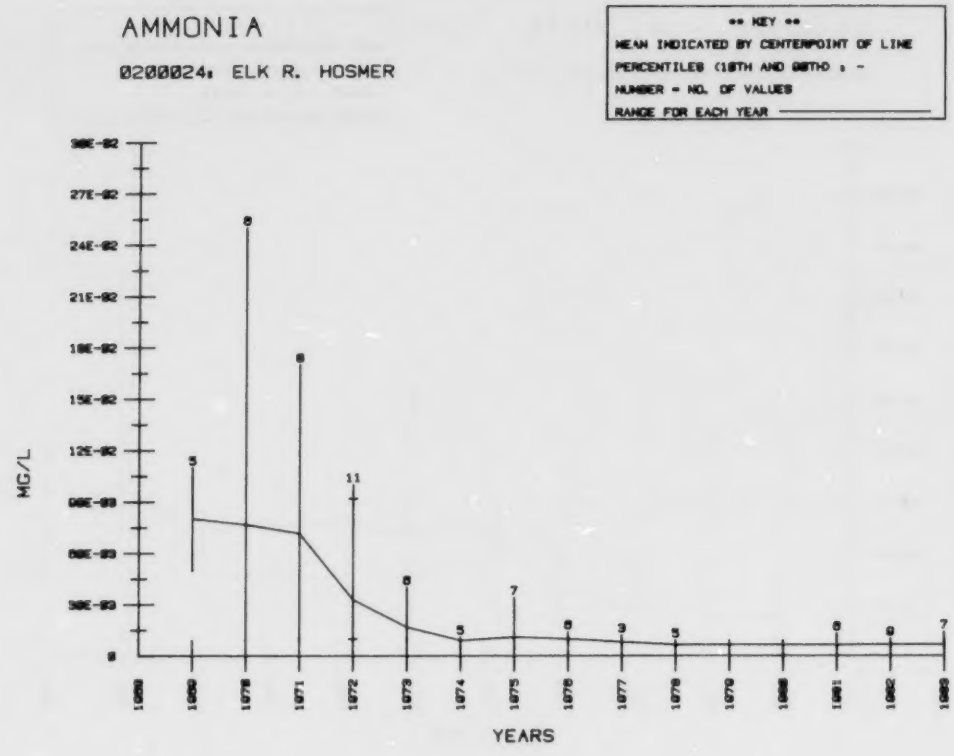
NITRATE + NITRITE

0200102: ELK R. SOUTH OF SPARWOOD



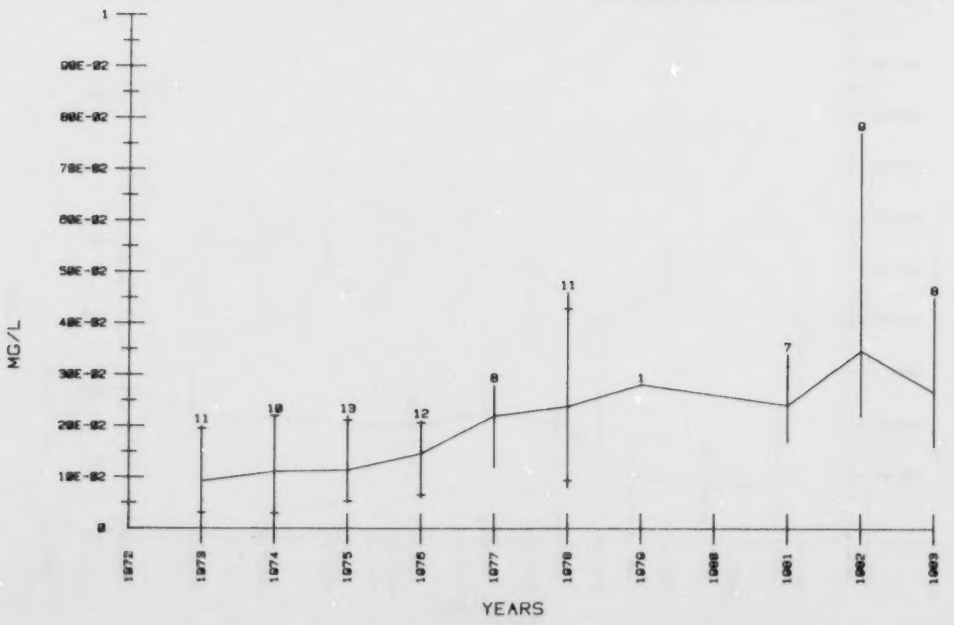
AMMONIA

0200024: ELK R. HOSMER



NITRATE + NITRITE

0200111: ELK R. NEAR NATAL



LAB PH

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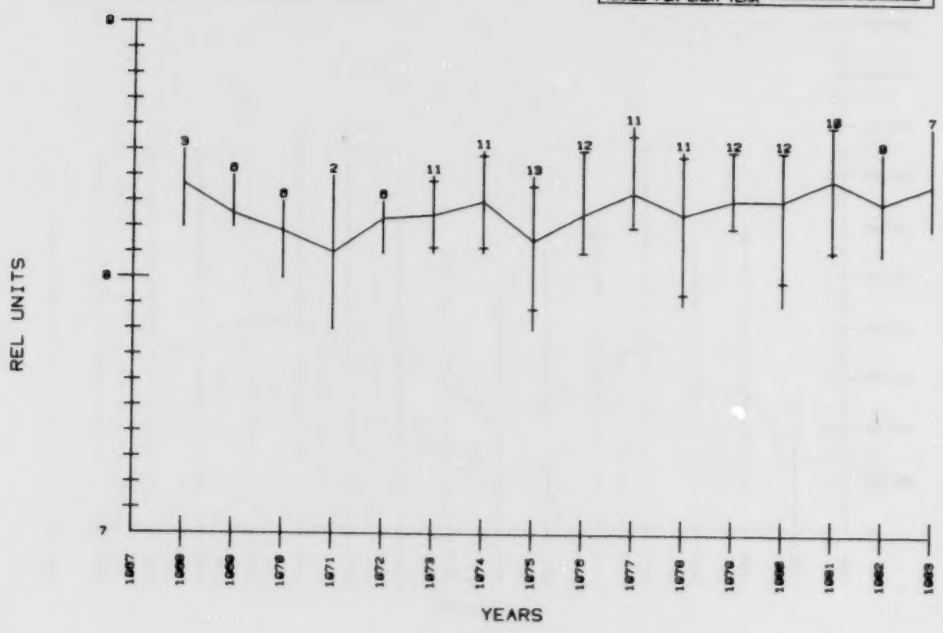

CHLORIDE

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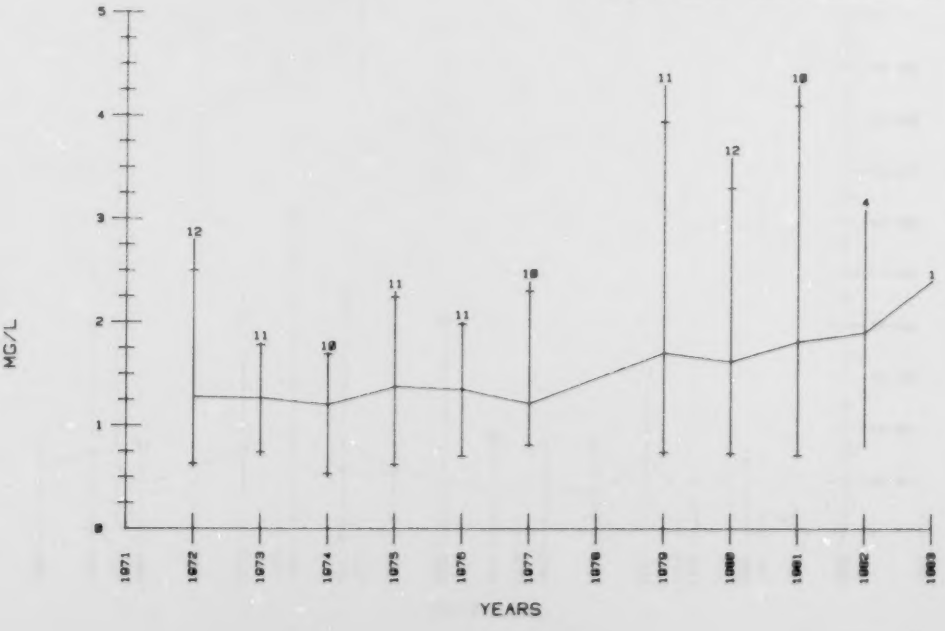

NITRATE + NITRITE

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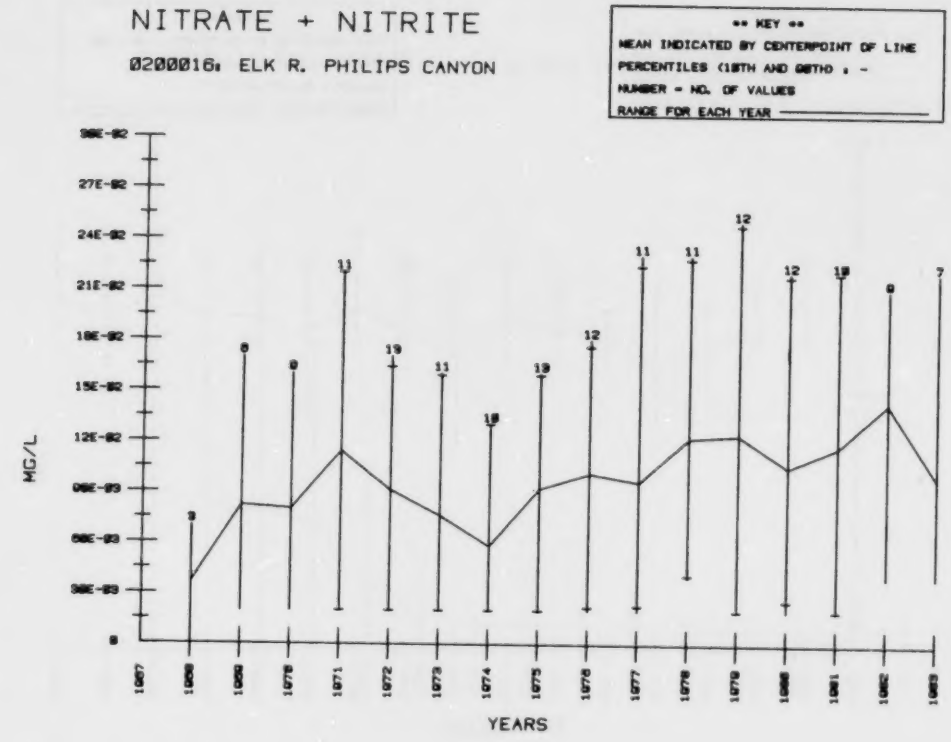
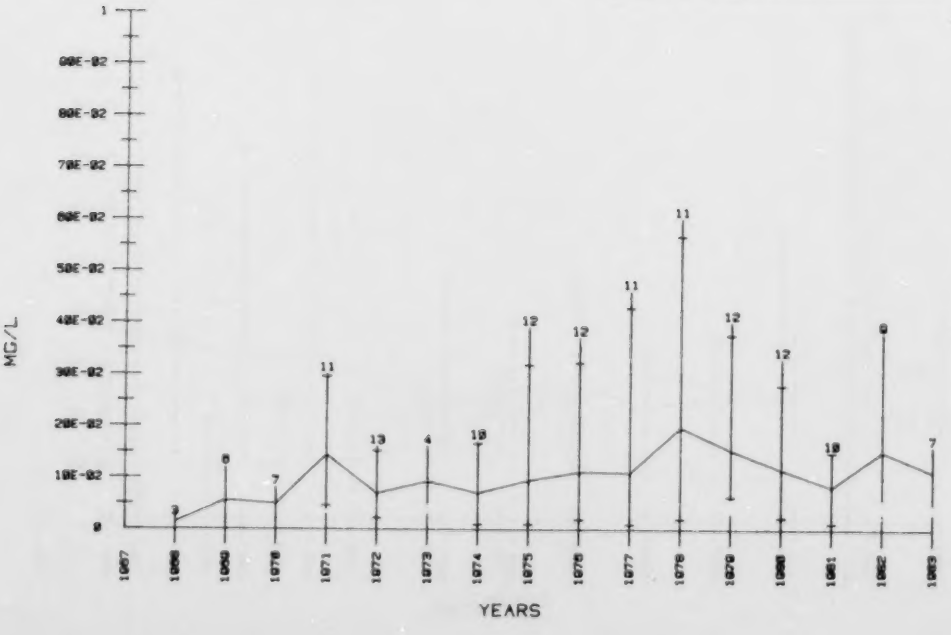


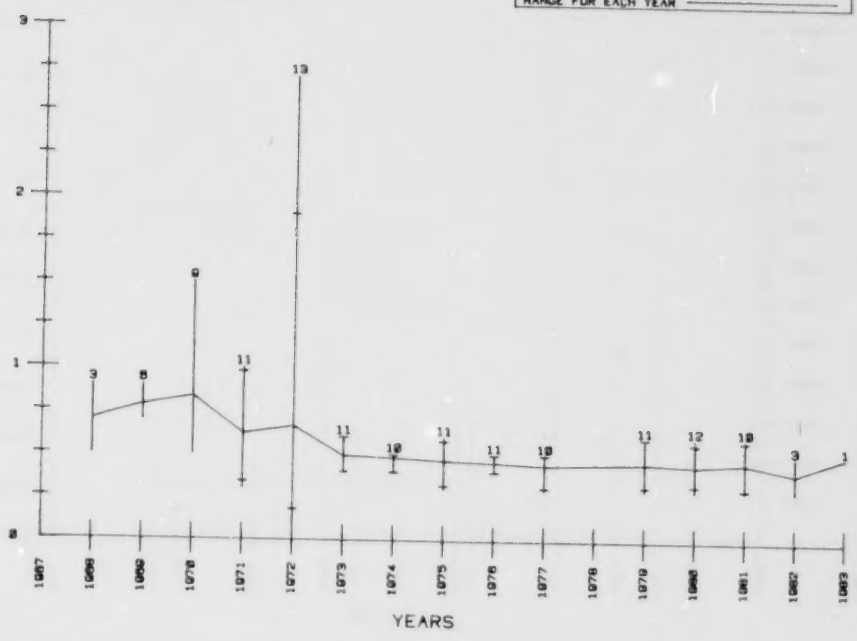
ORGANIC NITROGEN

0200016: ELK R. PHILIPS CANYON



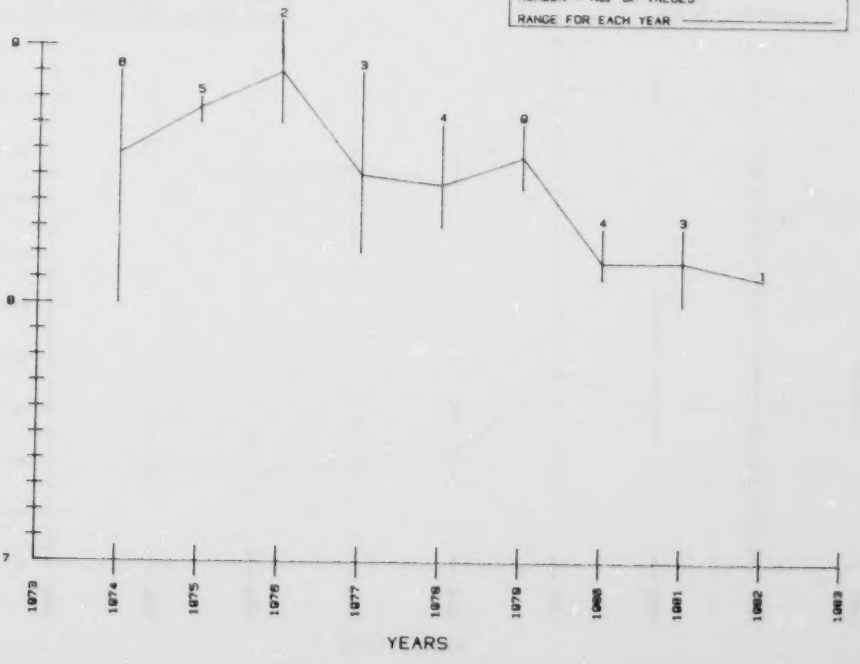
DISSOLVED POTASSIUM

0200016: ELK R. PHILIPS CANYON



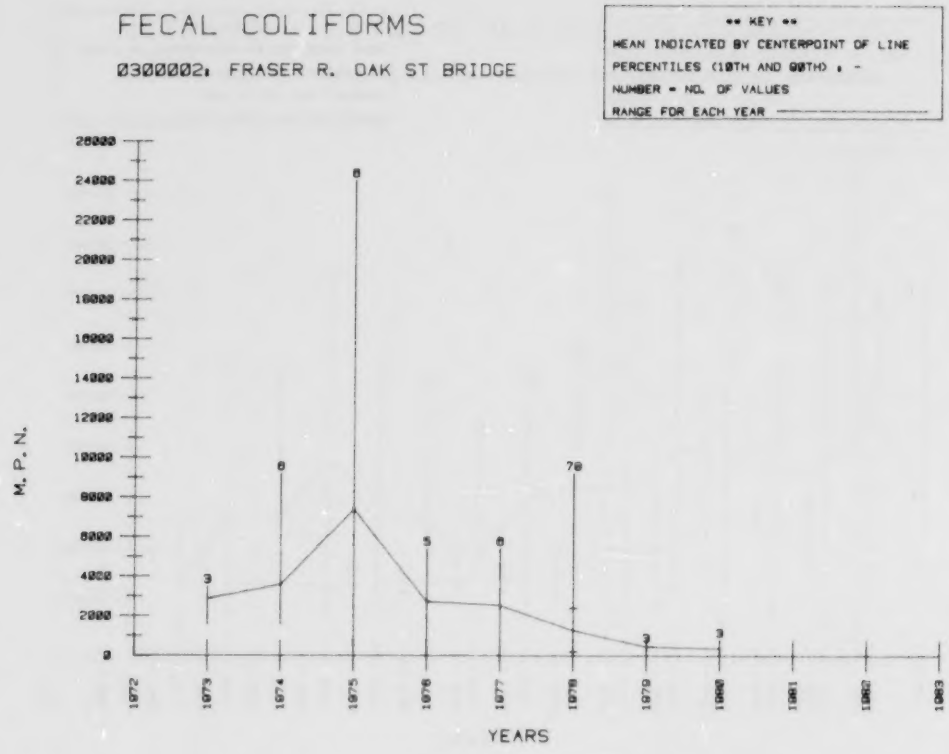
FIELD PH

0500324: ENEAS CR. AT MOUTH



FECAL COLIFORMS

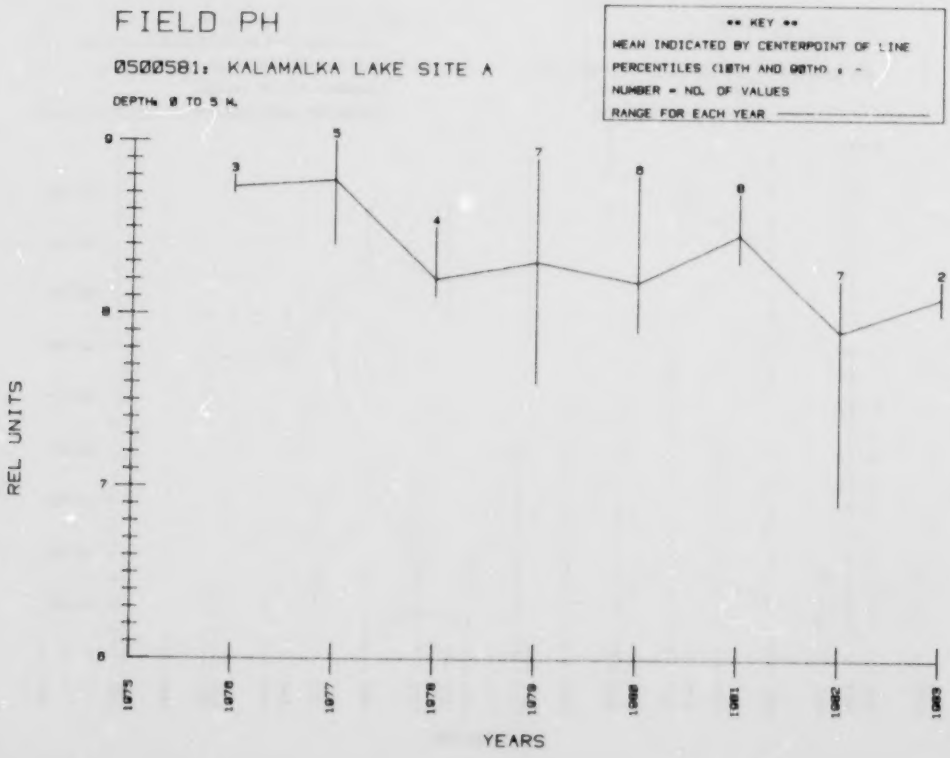
0300002: FRASER R. OAK ST BRIDGE



FIELD PH

0500581: KALAMALKA LAKE SITE A

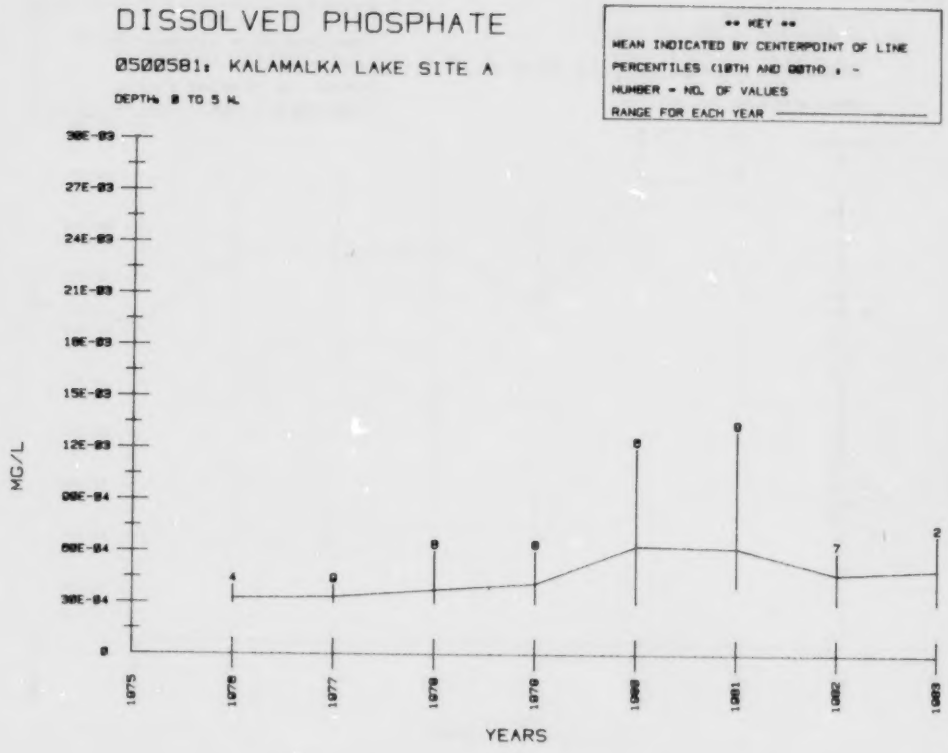
DEPTH 0 TO 5 M.



DISSOLVED PHOSPHATE

0500581: KALAMALKA LAKE SITE A

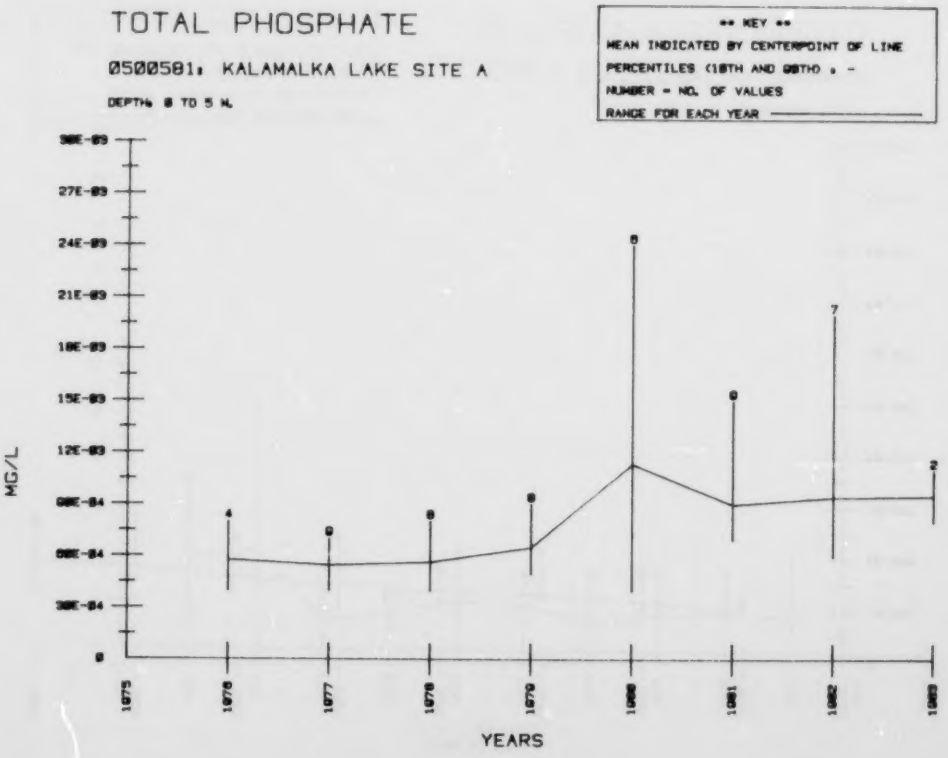
DEPTH: 0 TO 5 M.



TOTAL PHOSPHATE

0500581: KALAMALKA LAKE SITE A

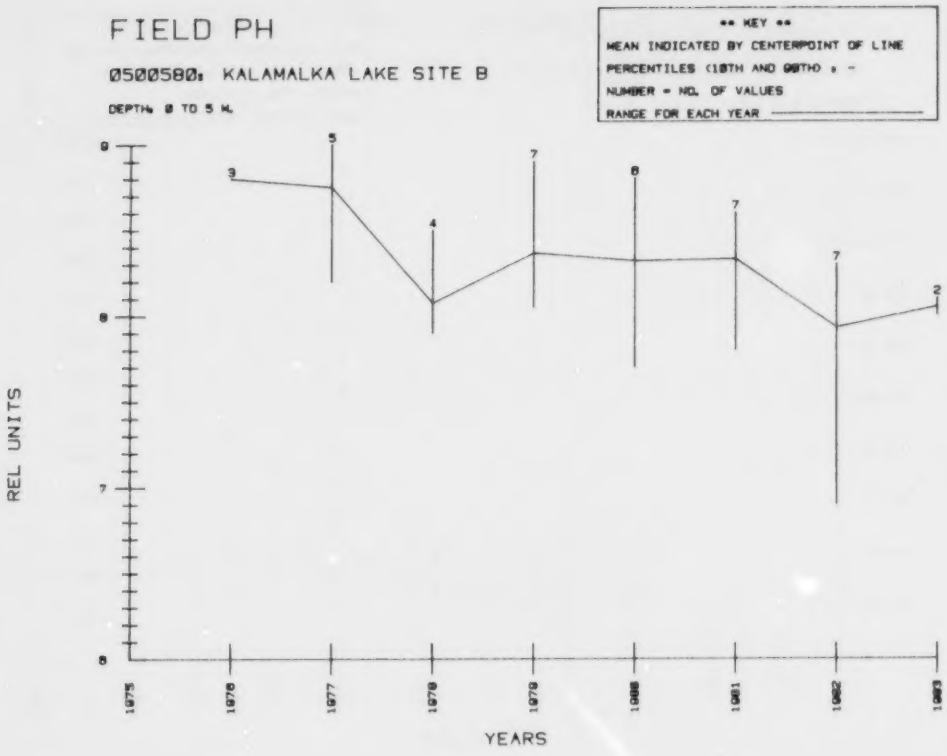
DEPTH: 0 TO 5 M.



FIELD PH

0500580: KALAMALKA LAKE SITE B

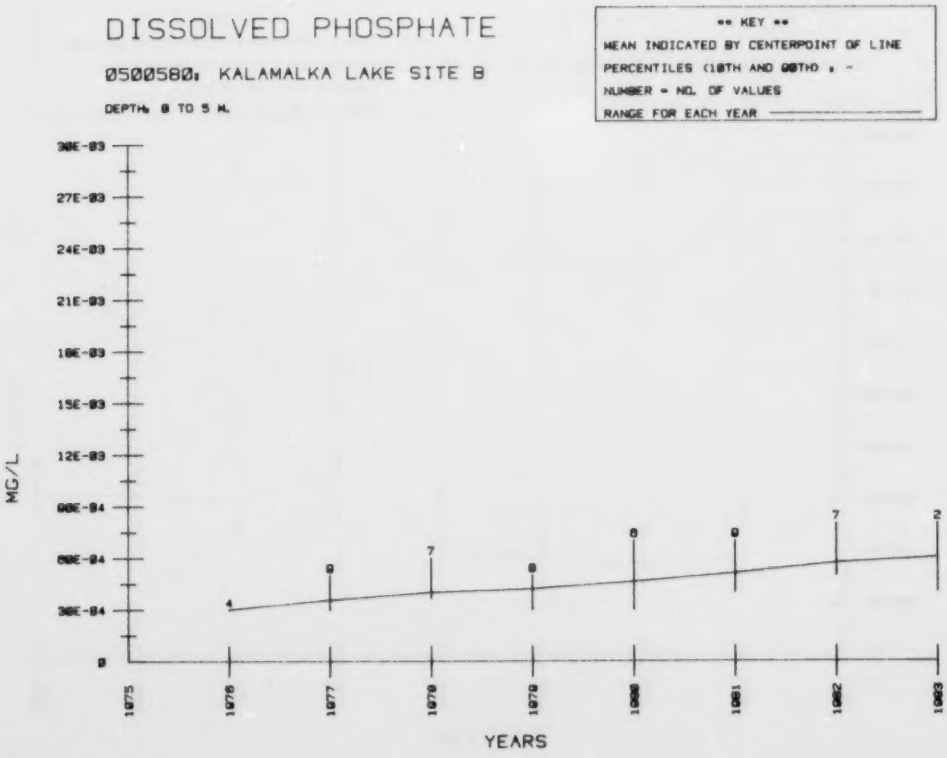
DEPTH: 0 TO 5 M.



DISSOLVED PHOSPHATE

0500580: KALAMALKA LAKE SITE B

DEPTH: 0 TO 5 M.

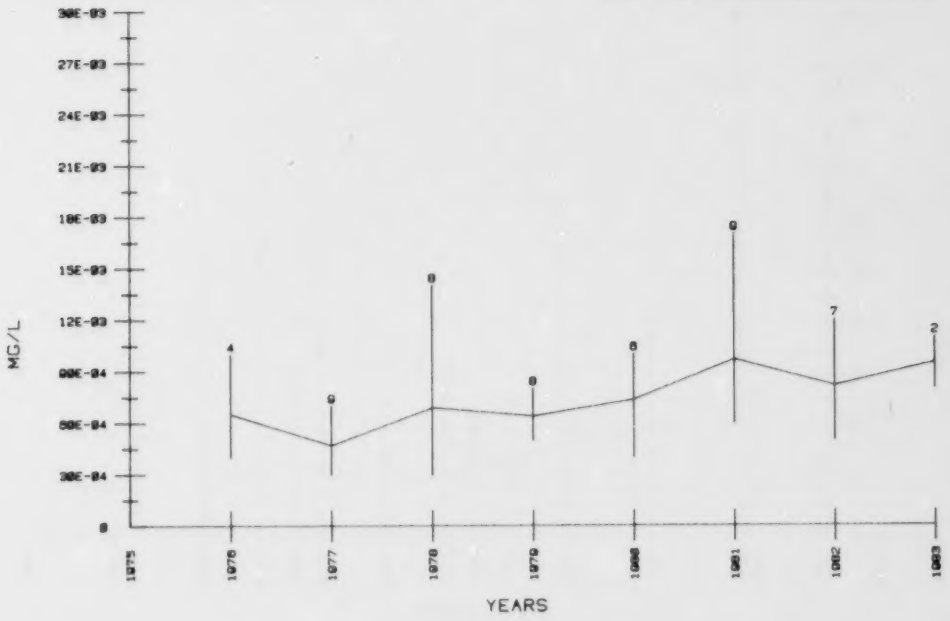


TOTAL PHOSPHATE

0500580: KALAMALKA LAKE SITE B

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

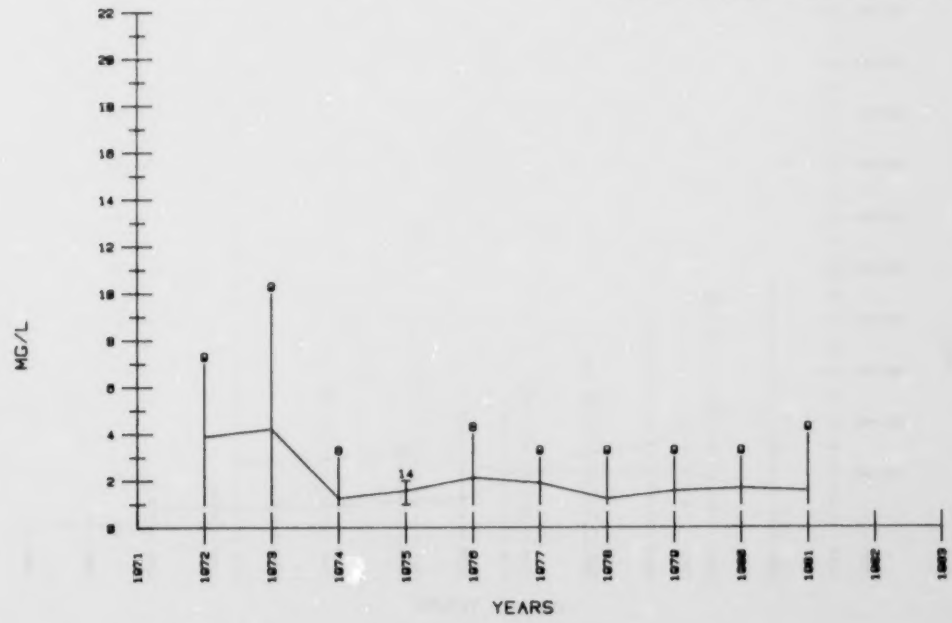


ORGANIC CARBON

0200031: KOOTENAY LAKE - KUSKONOOK

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

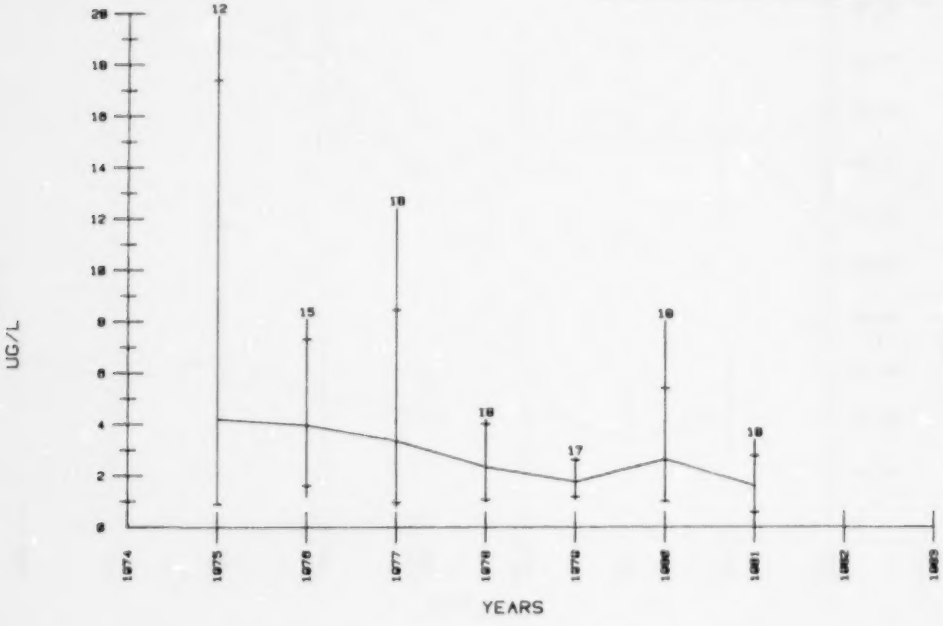


CHLOROPHYLL A

0200031: KOOTENAY LAKE - KUSKONOOK

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

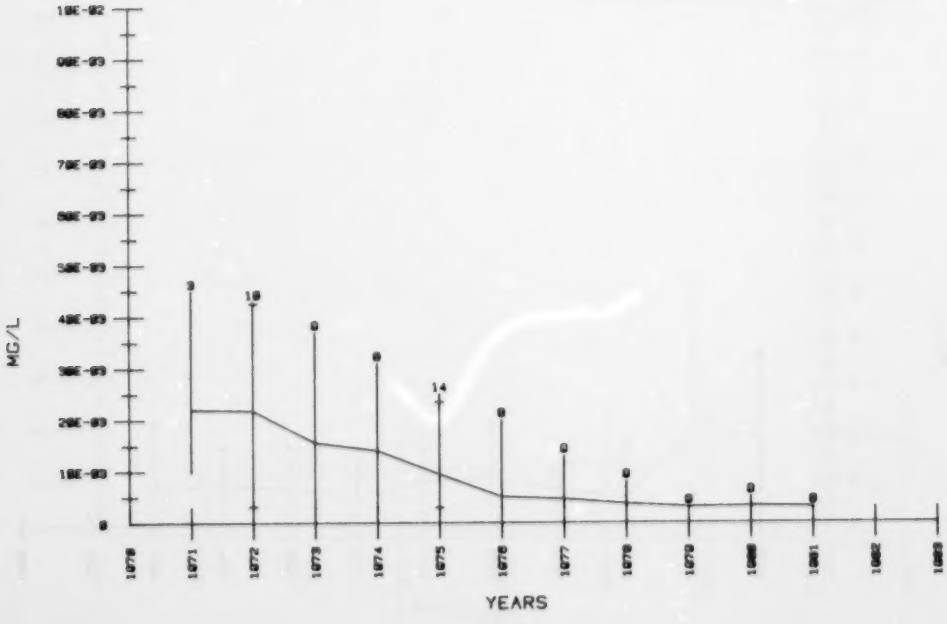


ORTHO PHOSPHATE

0200031: KOOTENAY LAKE - KUSKONOOK

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

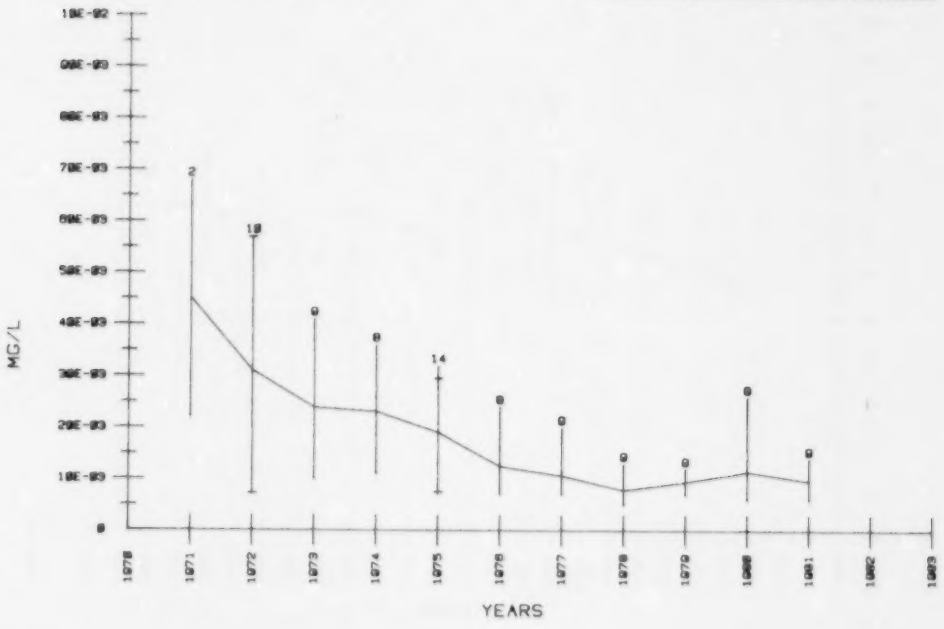


TOTAL PHOSPHATE

0200031: KOOTENAY LAKE - KUSKONOOK

DEPTH: 0 TO 5 M

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——

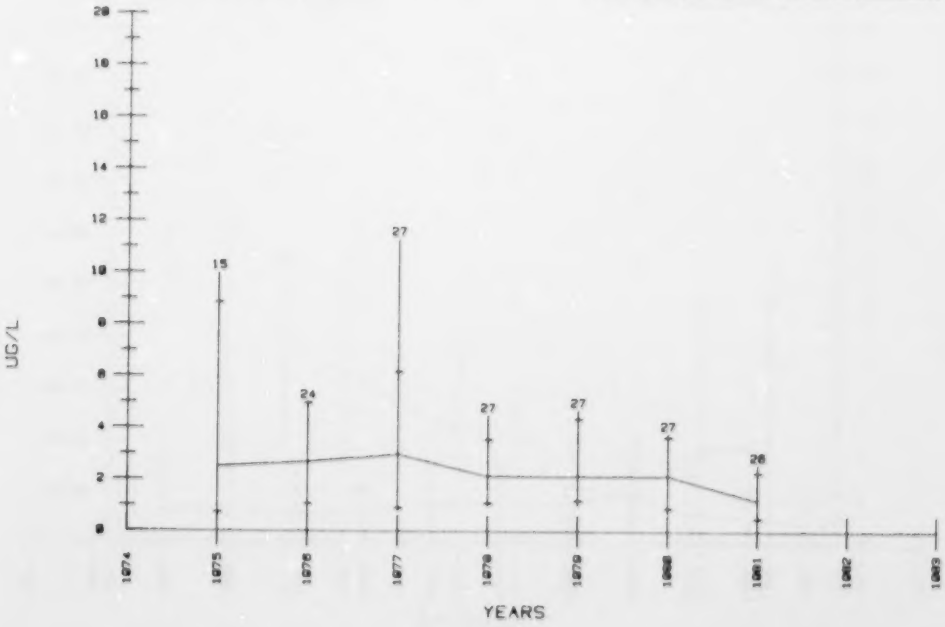


CHLOROPHYLL A

0200031: KOOTENAY LAKE - KUSKONOOK

DEPTH: 5.1 TO 25 M

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——

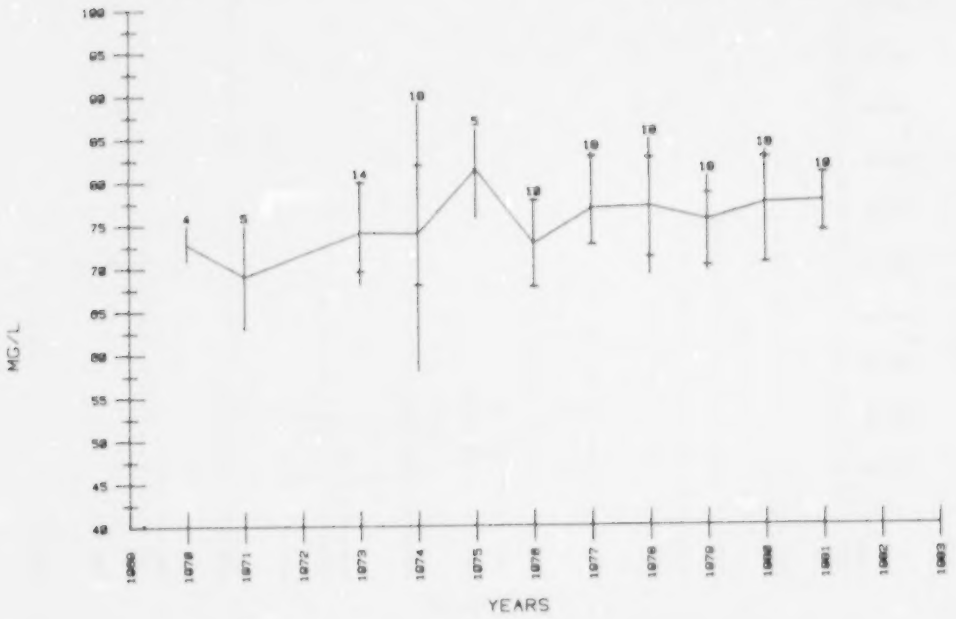


TOTAL ALKALINITY

0200031: KOOTENAY LAKE - KUSKONOOK

DEPTH: GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——

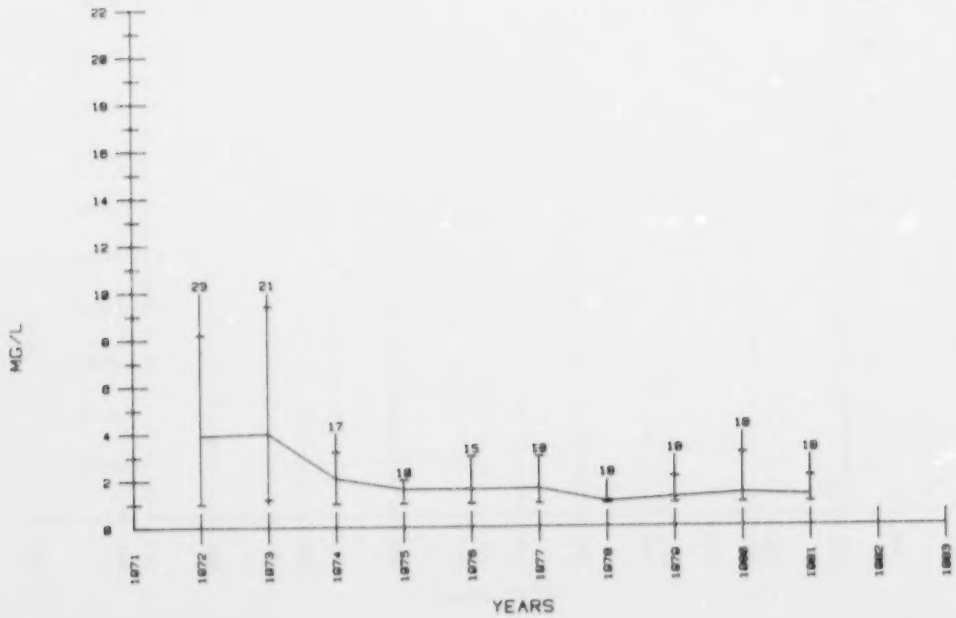


ORGANIC CARBON

0200031: KOOTENAY LAKE - KUSKONOOK

DEPTH: GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——

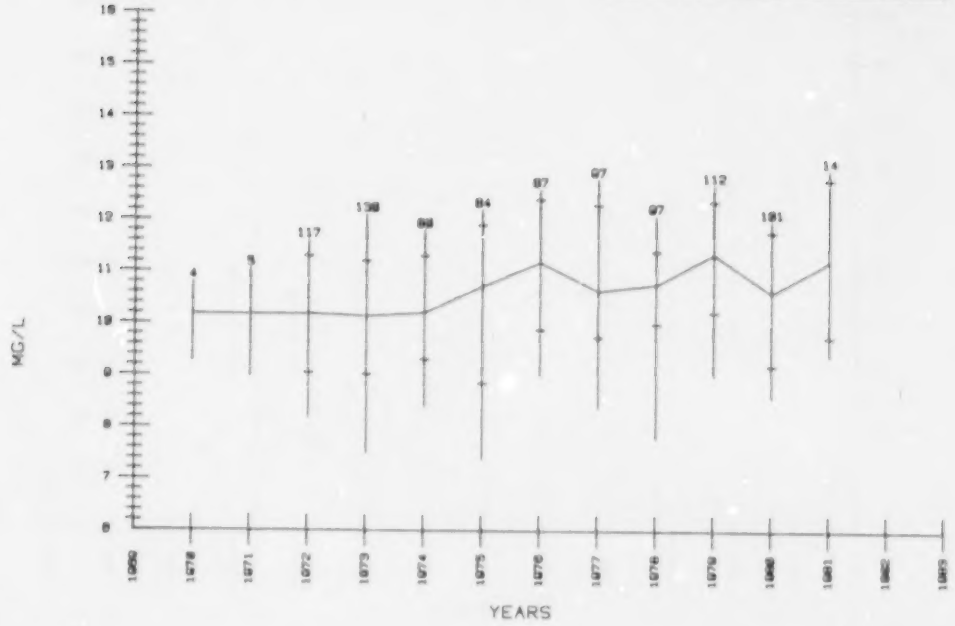


DISSOLVED OXYGEN

0200031: KOOTENAY LAKE - KUSKONOOK

DEPTH GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

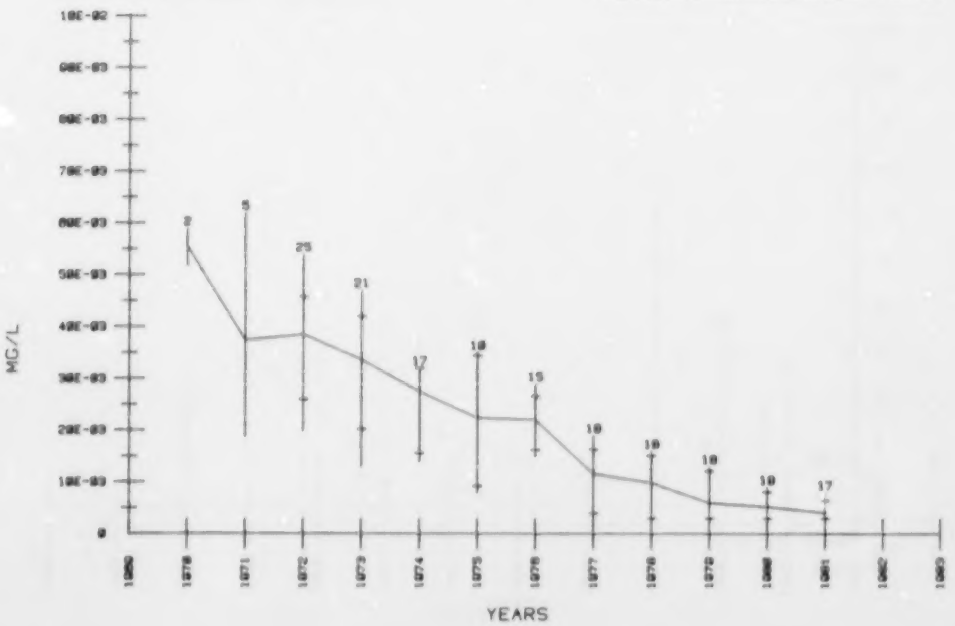


ORTHO PHOSPHATE

0200031: KOOTENAY LAKE - KUSKONOOK

DEPTH GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

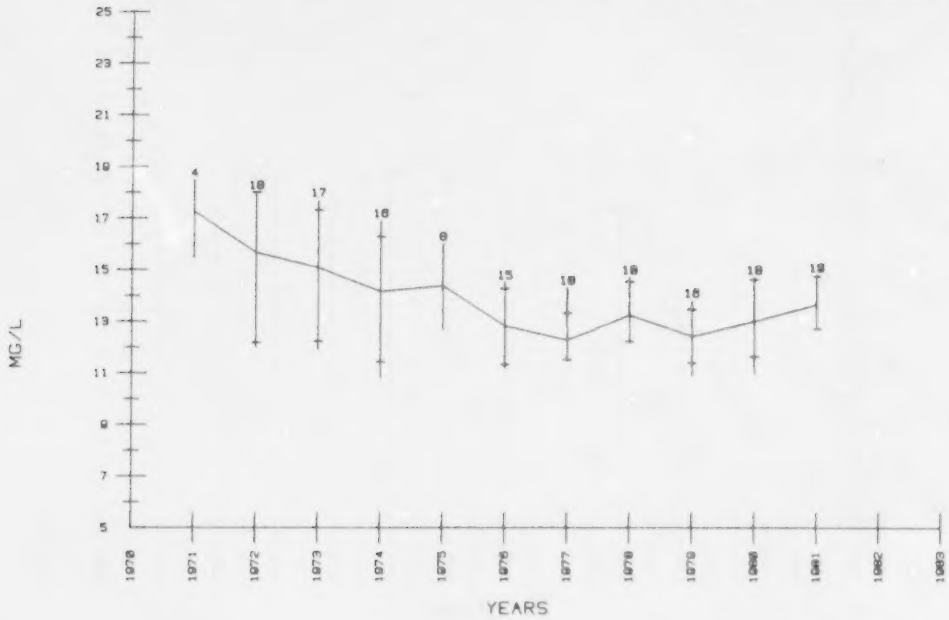


SULPHATE

0200031: KOOTENAY LAKE - KUSKONOOK

DEPTH: GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

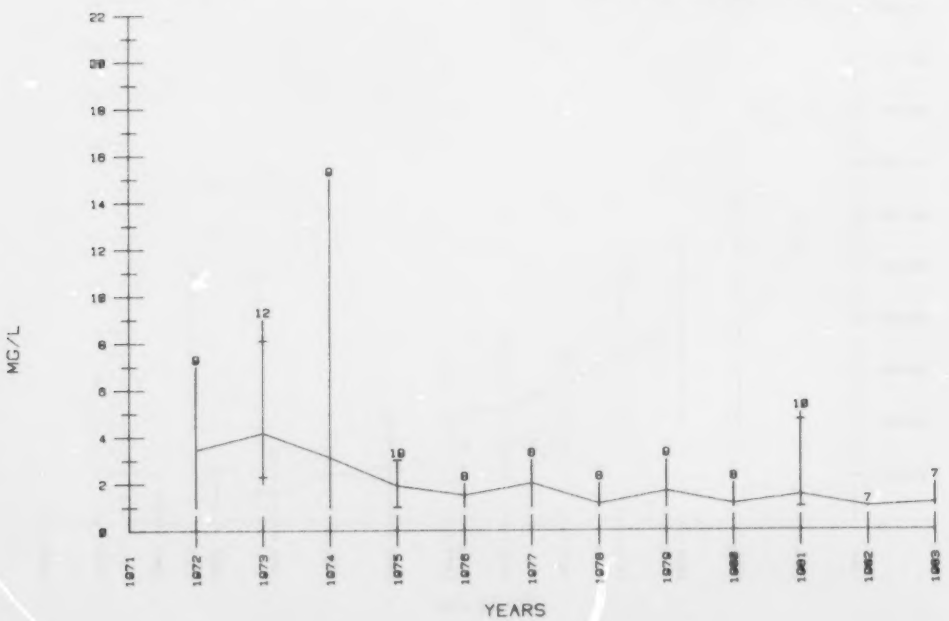


ORGANIC CARBON

0200034: KOOTENAY LAKE - CAPE HORN

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

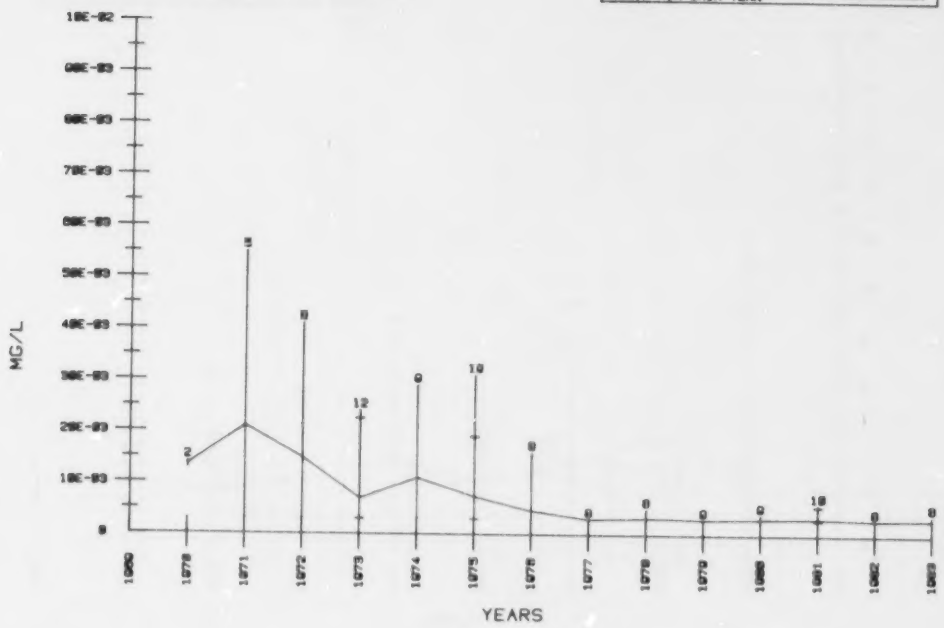


ORTHO PHOSPHATE

0200034: KOOTENAY LAKE - CAPE HORN

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR

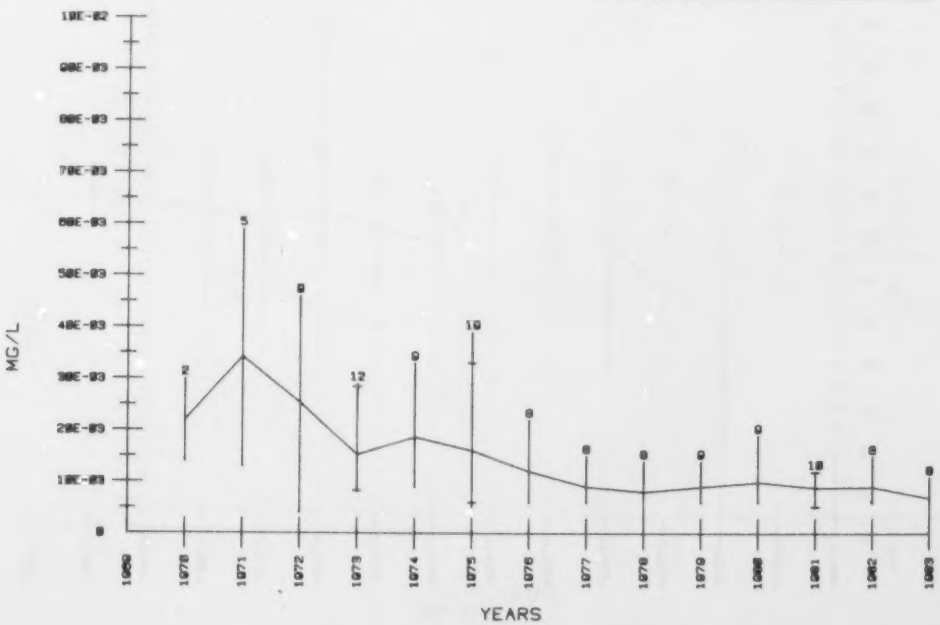


TOTAL PHOSPHATE

0200034: KOOTENAY LAKE - CAPE HORN

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR

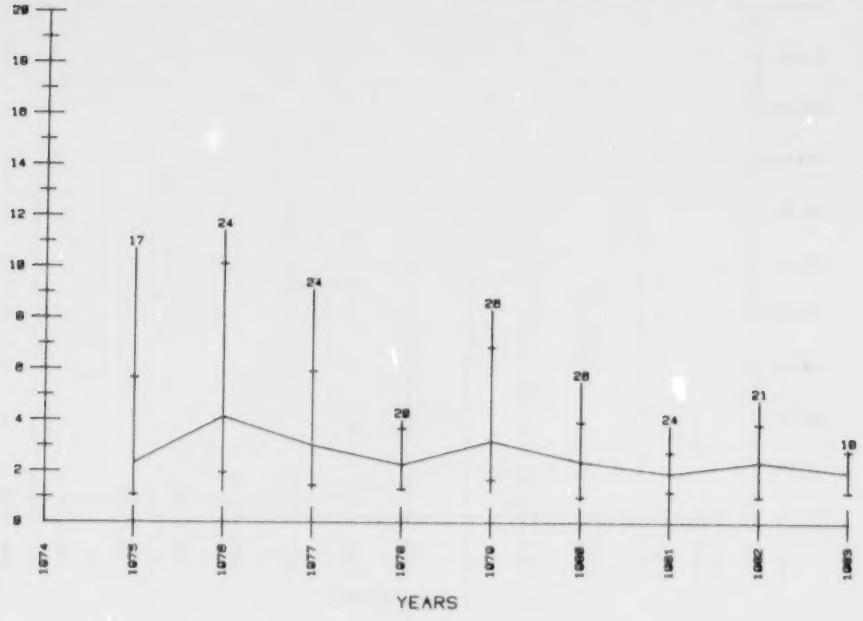


CHLOROPHYLL A

0200034: KOOTENAY LAKE - CAPE HORN

DEPTH: 5.1 TO 25 M

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

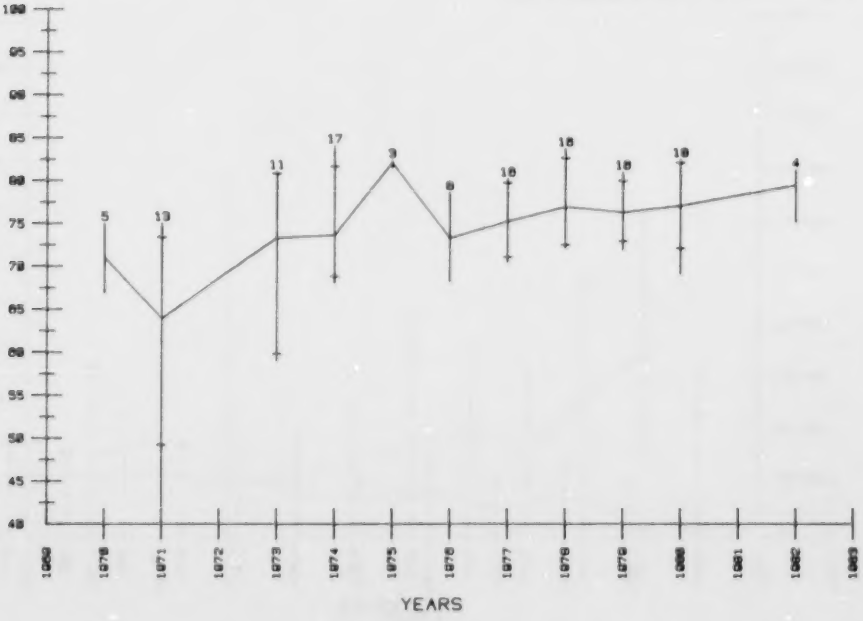


TOTAL ALKALINITY

0200034: KOOTENAY LAKE - CAPE HORN

DEPTH: GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

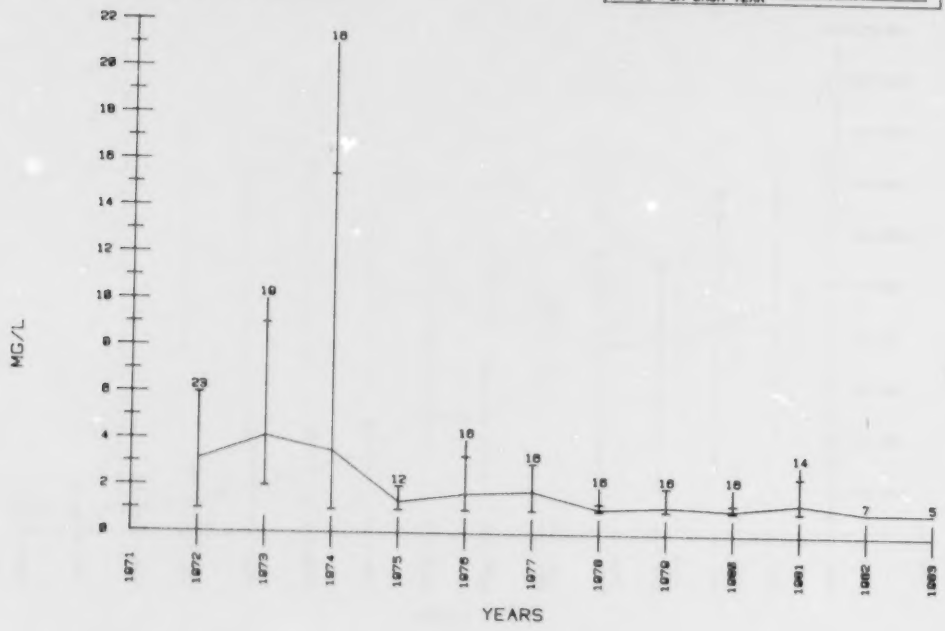


ORGANIC CARBON

0200034: KOOTENAY LAKE - CAPE HORN

DEPTH: GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

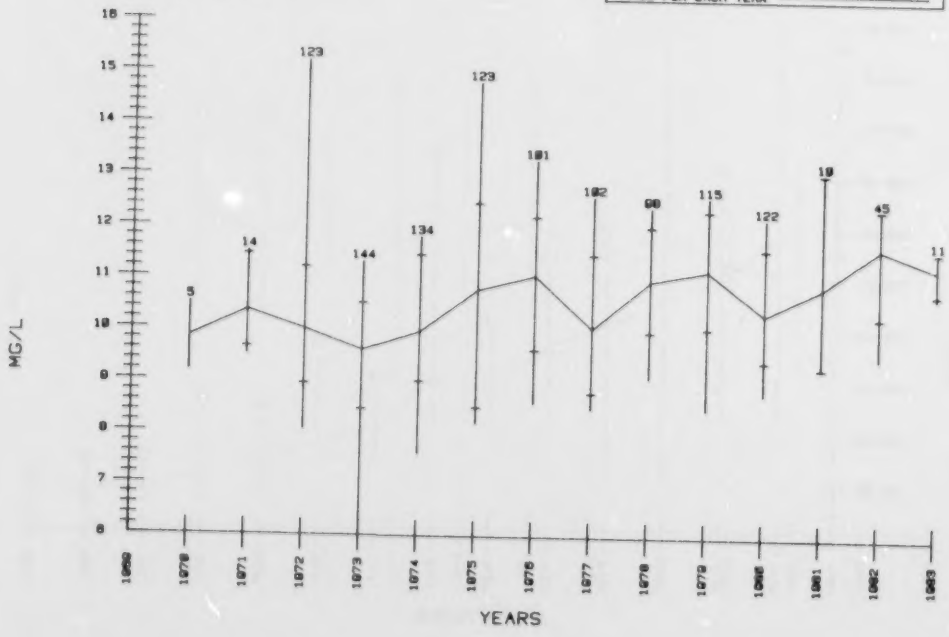


DISSOLVED OXYGEN

0200034: KOOTENAY LAKE - CAPE HORN

DEPTH: GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

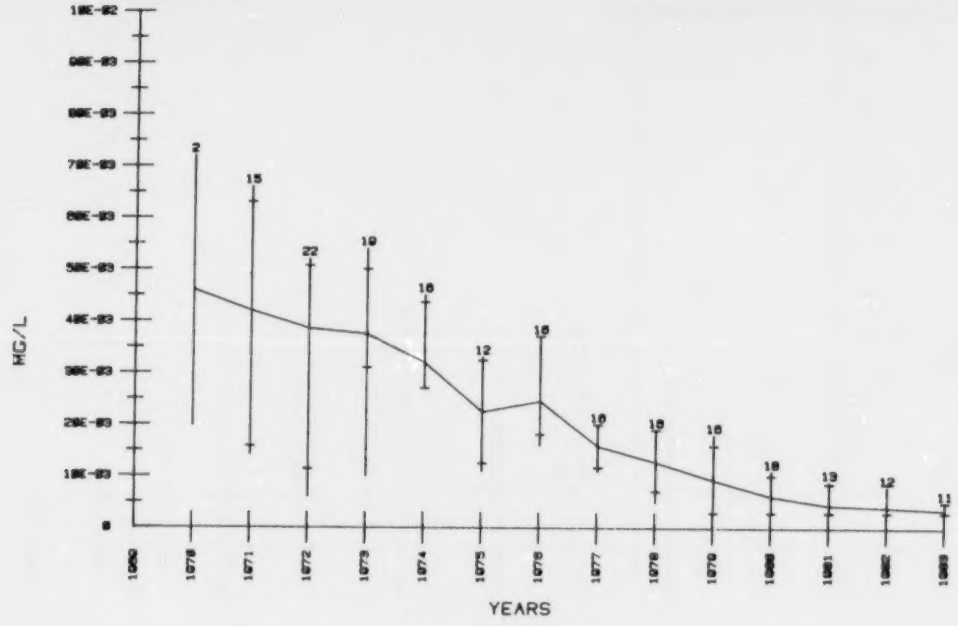


ORTHO PHOSPHATE

0200034: KOOTENAY LAKE - CAPE HORN

DEPTH: GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

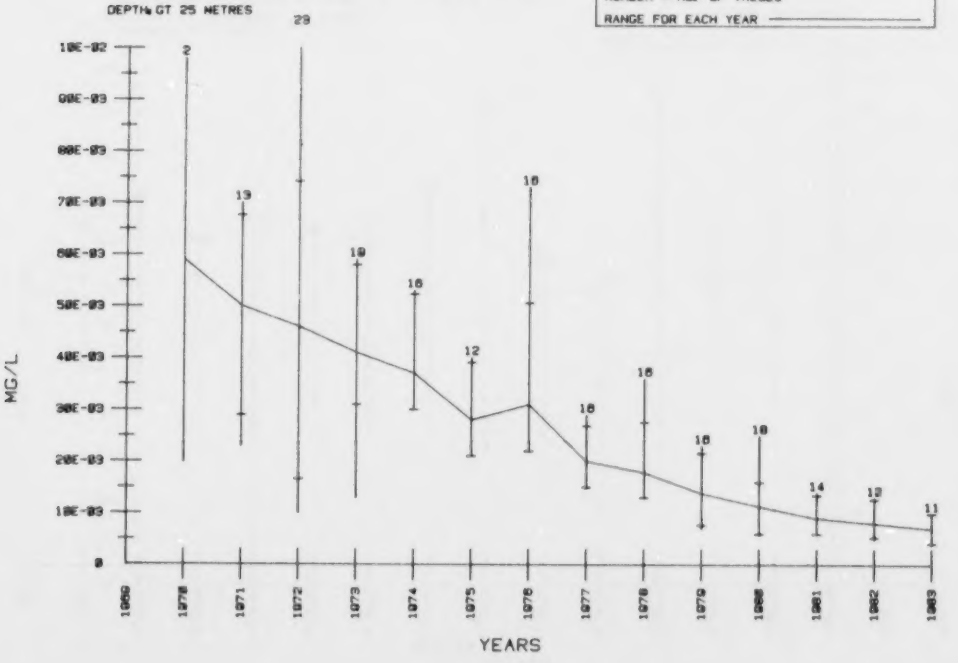


TOTAL PHOSPHATE

0200034: KOOTENAY LAKE - CAPE HORN

DEPTH: GT 25 METRES

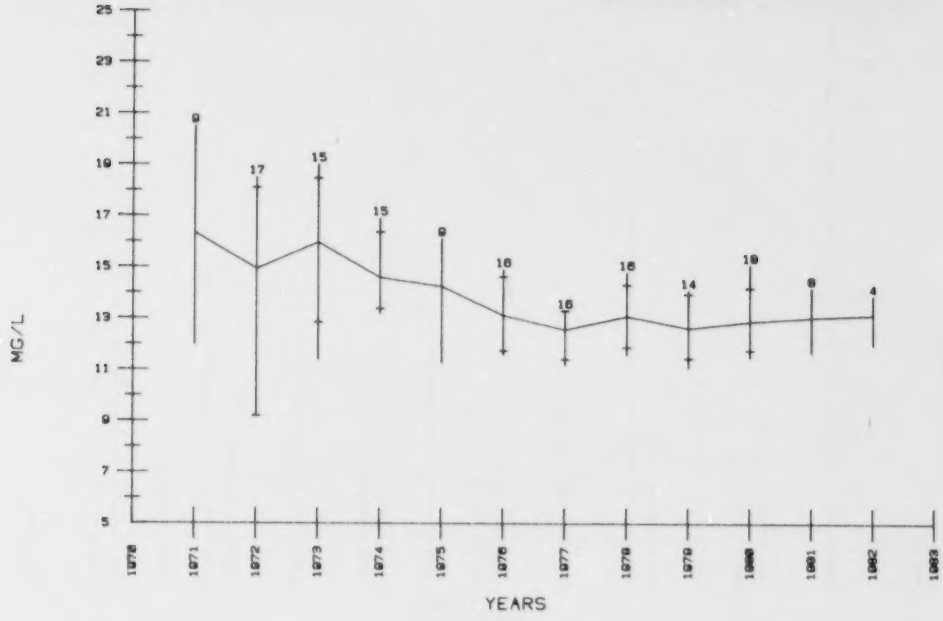
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————



SULPHATE

0200034: KOOTENAY LAKE - CAPE HORN

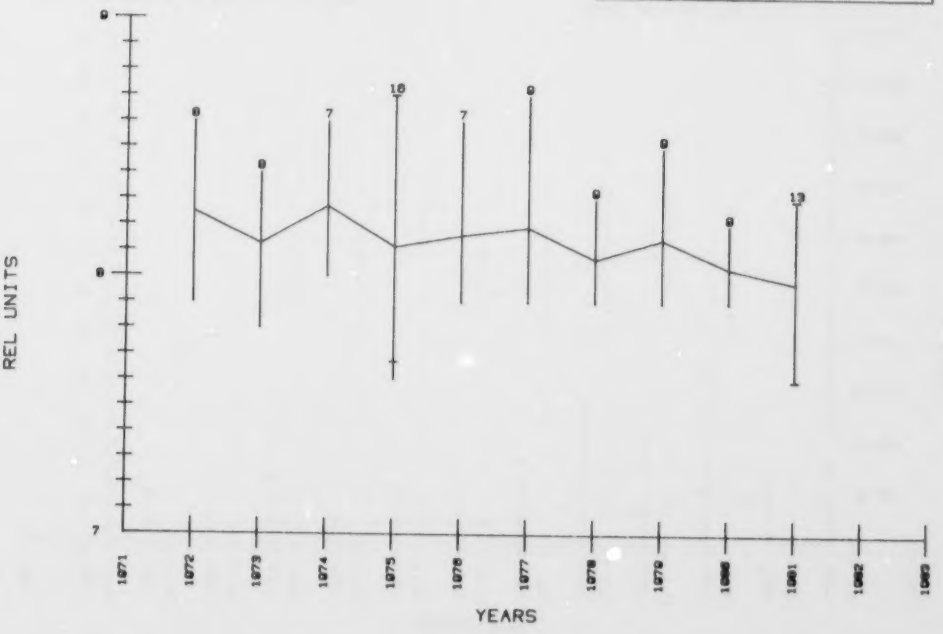
DEPTH: GT 25 METRES



LAB PH

0200057: KOOTENAY LAKE - KASLO

DEPTH: 0 TO 5 M

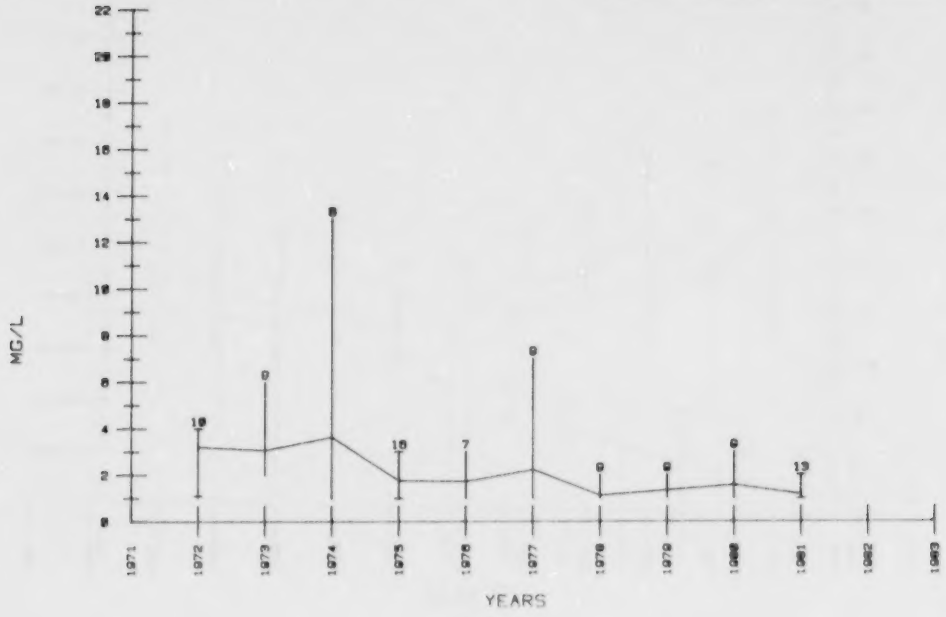


ORGANIC CARBON

0200057: KOOTENAY LAKE - KASLO

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

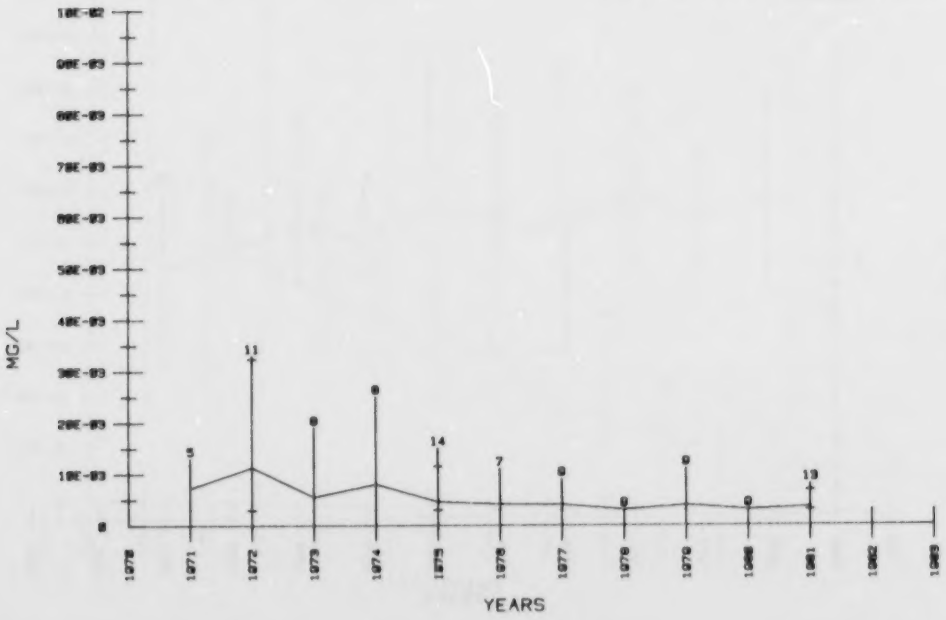


ORTHO PHOSPHATE

0200057: KOOTENAY LAKE - KASLO

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

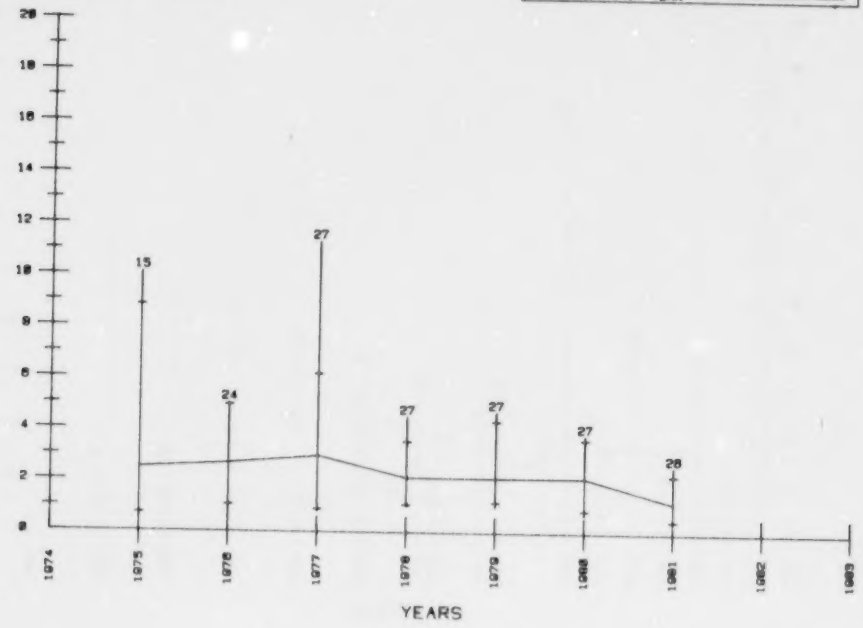


CHLOROPHYLL A

0200057: KOOTENAY LAKE - KASLO

DEPTH: 5.1 TO 25 M

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——

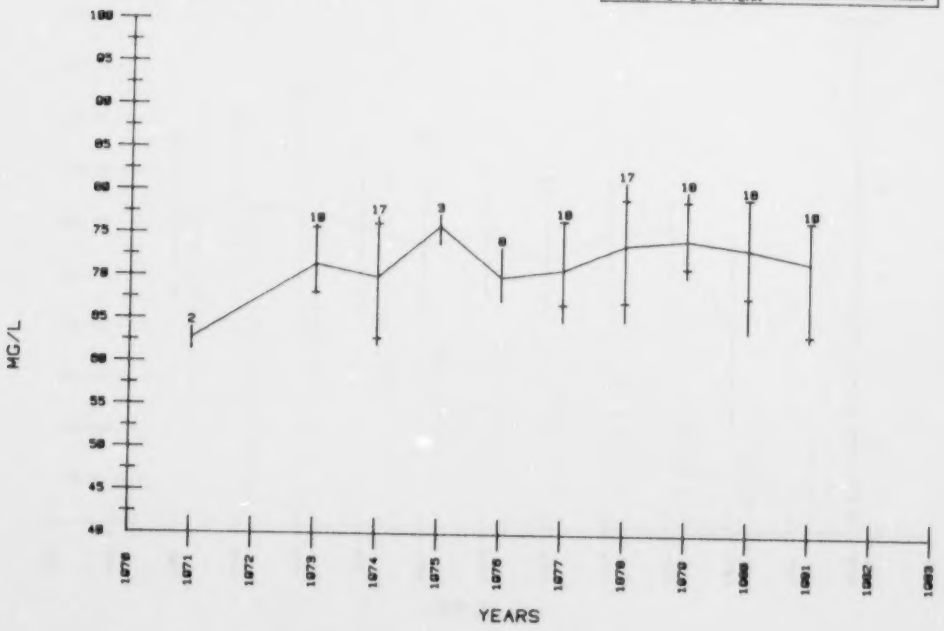


TOTAL ALKALINITY

0200057: KOOTENAY LAKE - KASLO

DEPTH: GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——

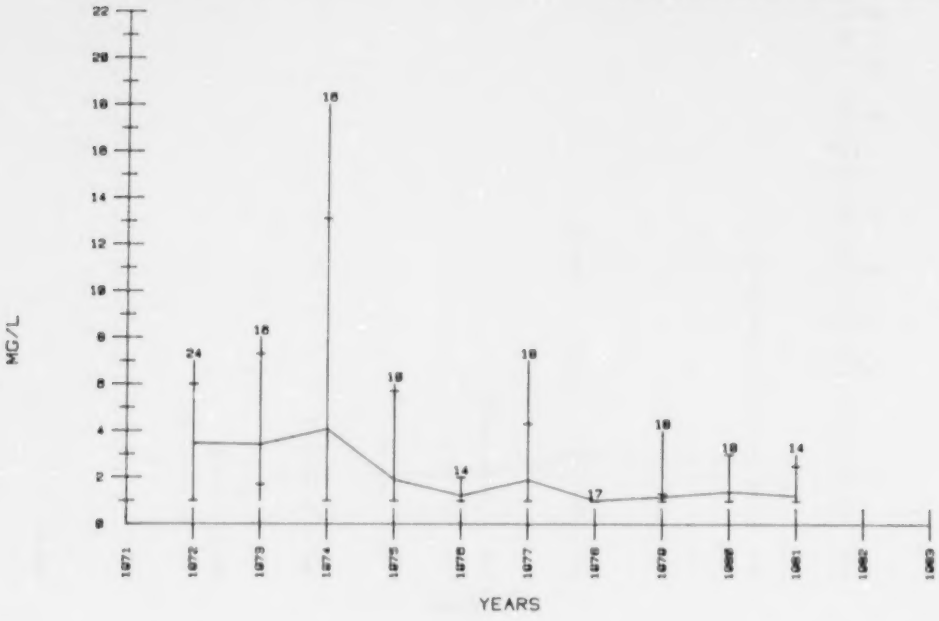


ORGANIC CARBON

0200057: KOOTENAY LAKE - KASLO

DEPTH GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

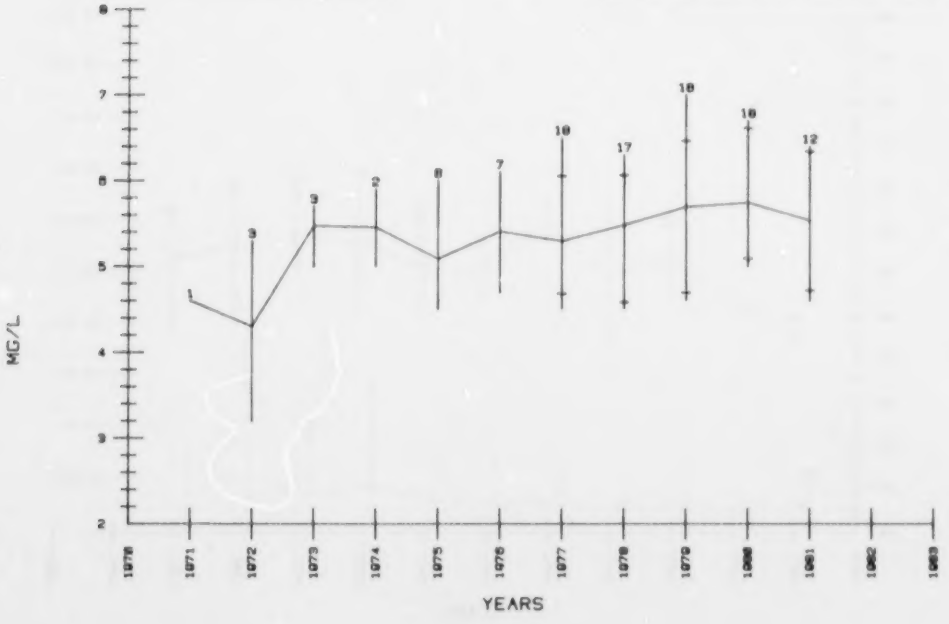


DISSOLVED MAGNESIUM

0200057: KOOTENAY LAKE - KASLO

DEPTH GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

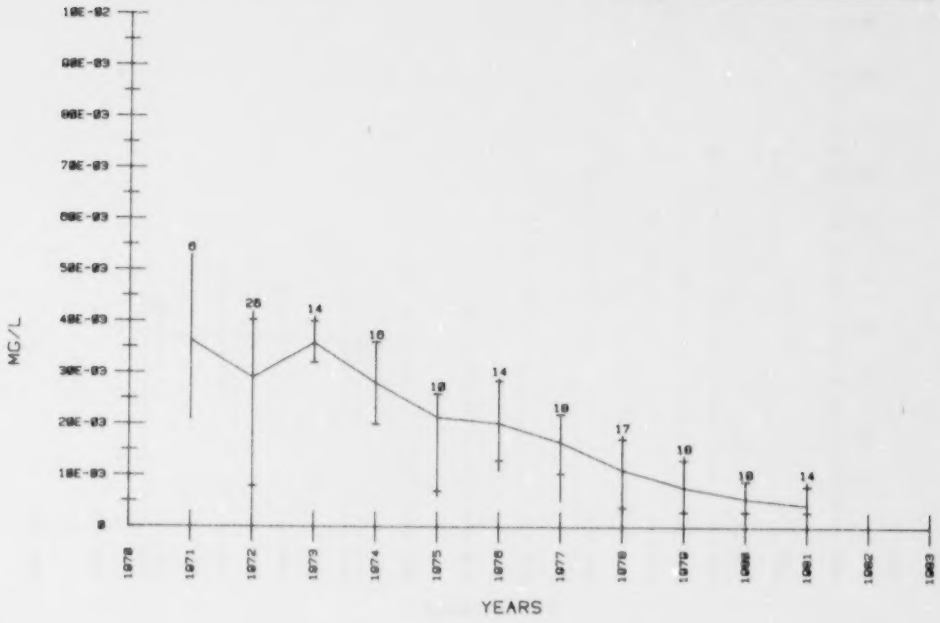


ORTHO PHOSPHATE

0200057, KOOTENAY LAKE - KASLO

DEPTH GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR

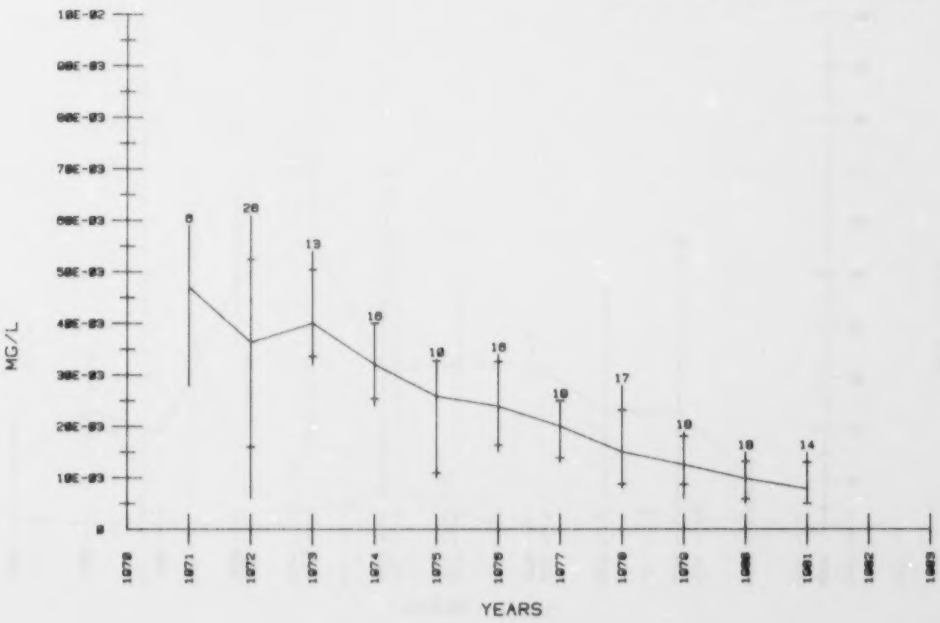


TOTAL PHOSPHATE

0200057, KOOTENAY LAKE - KASLO

DEPTH GT 25 METRES

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR

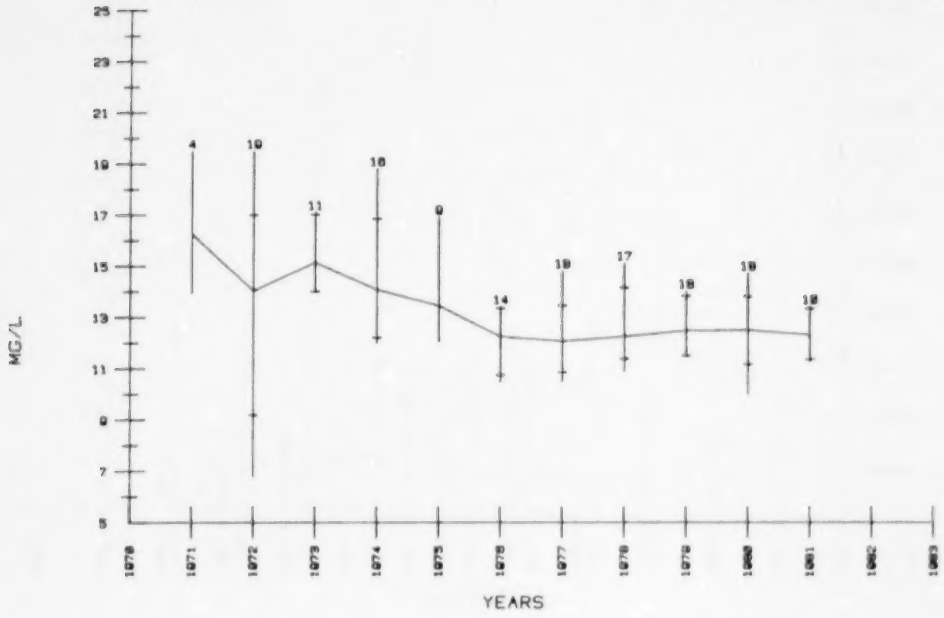


SULPHATE

0200057: KOOTENAY LAKE - KASLO

DEPTH GT 25 METRES

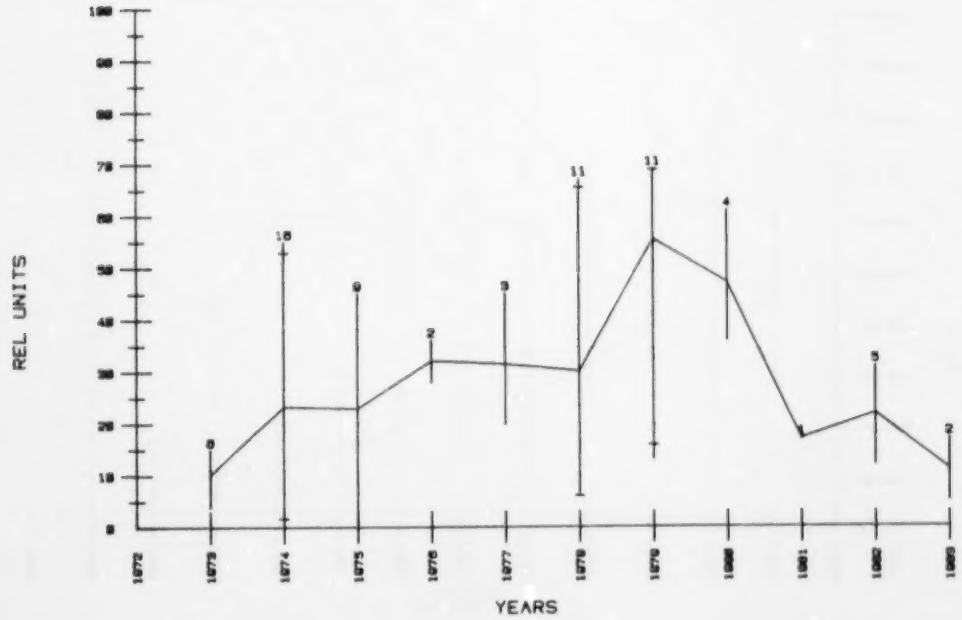
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————



COLOUR

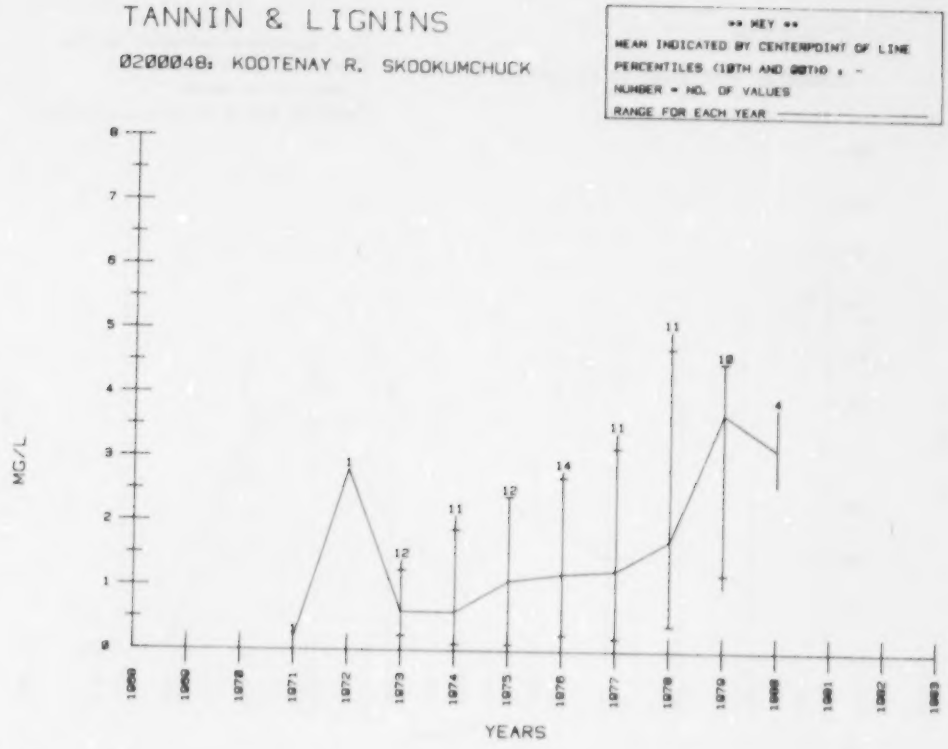
0200048: KOOTENAY R. SKOOKUMCHUCK

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————



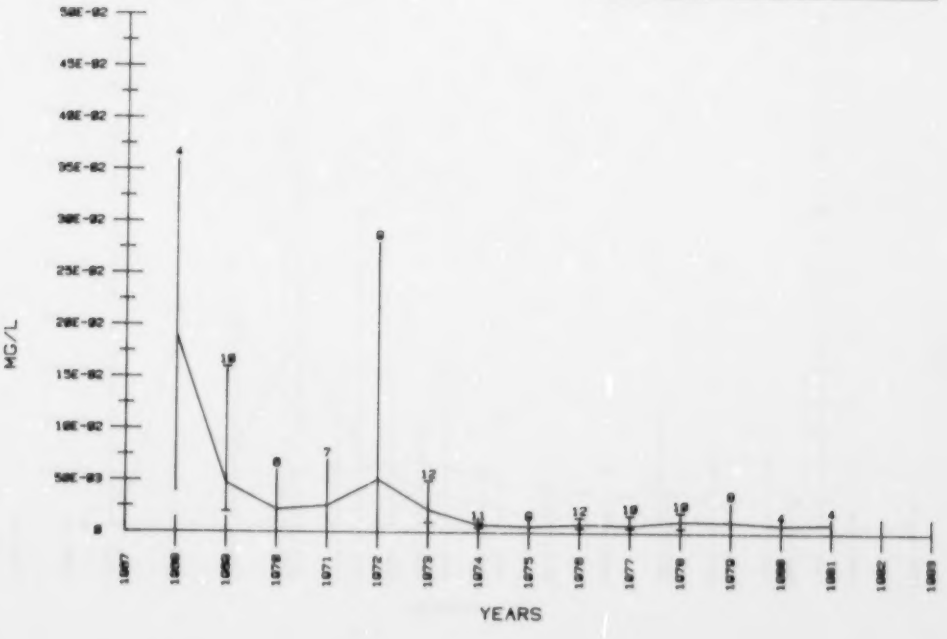
TANNIN & LIGNINS

0200048: KOOTENAY R. SKOOKUMCHUCK



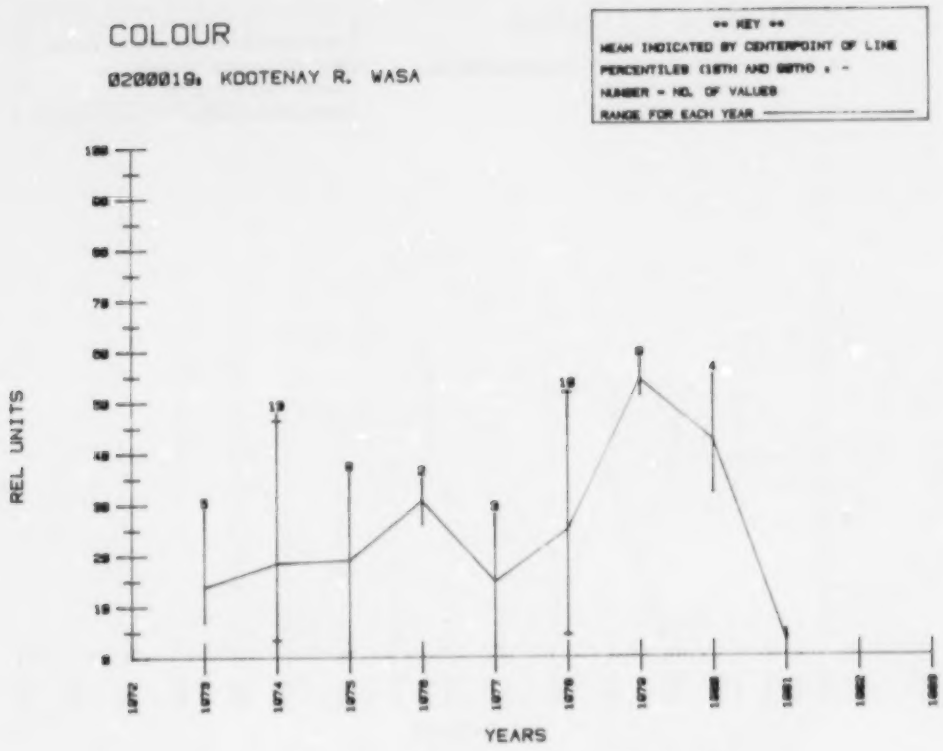
AMMONIA

0200019: KOOTENAY R. WASA



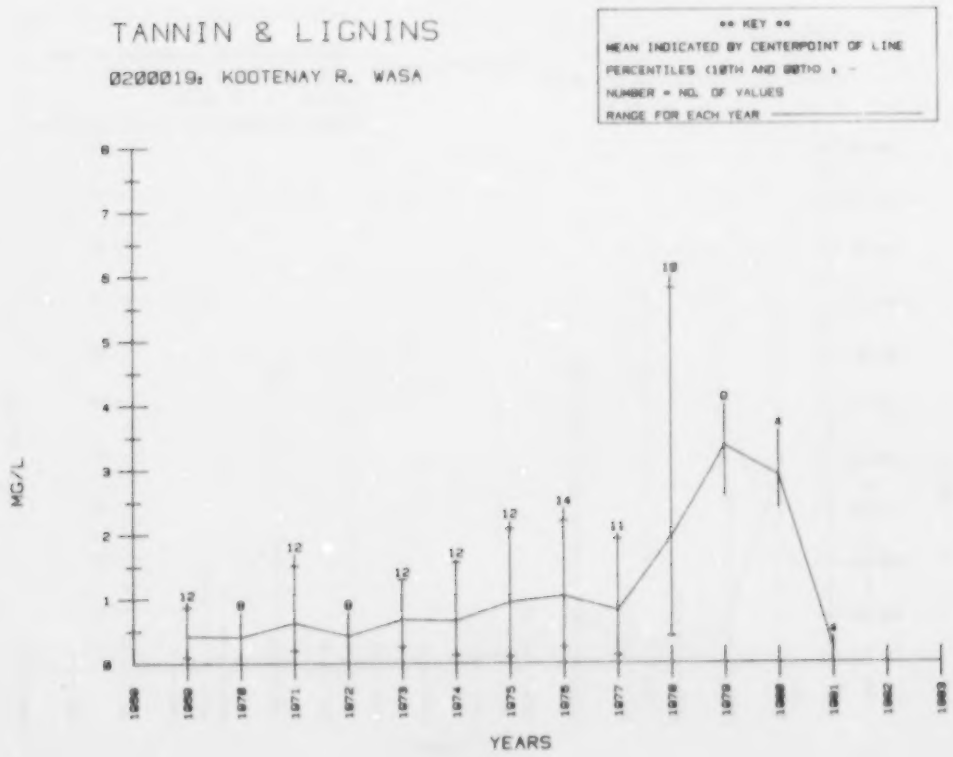
COLOUR

0200019: KOOTENAY R. WASA



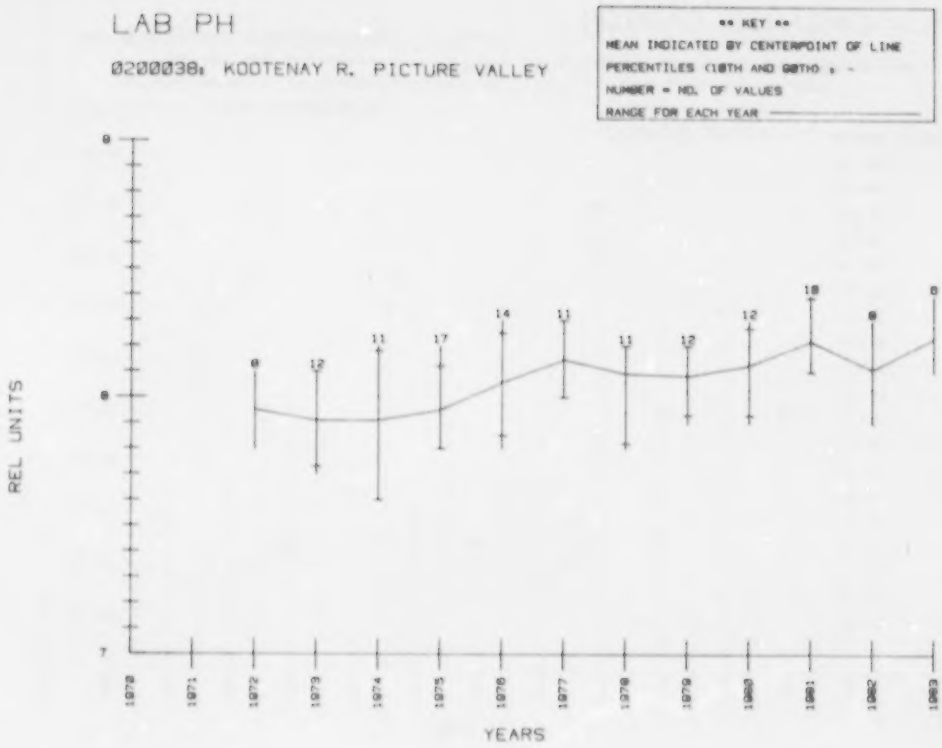
TANNIN & LIGNINS

0200019: KOOTENAY R. WASA



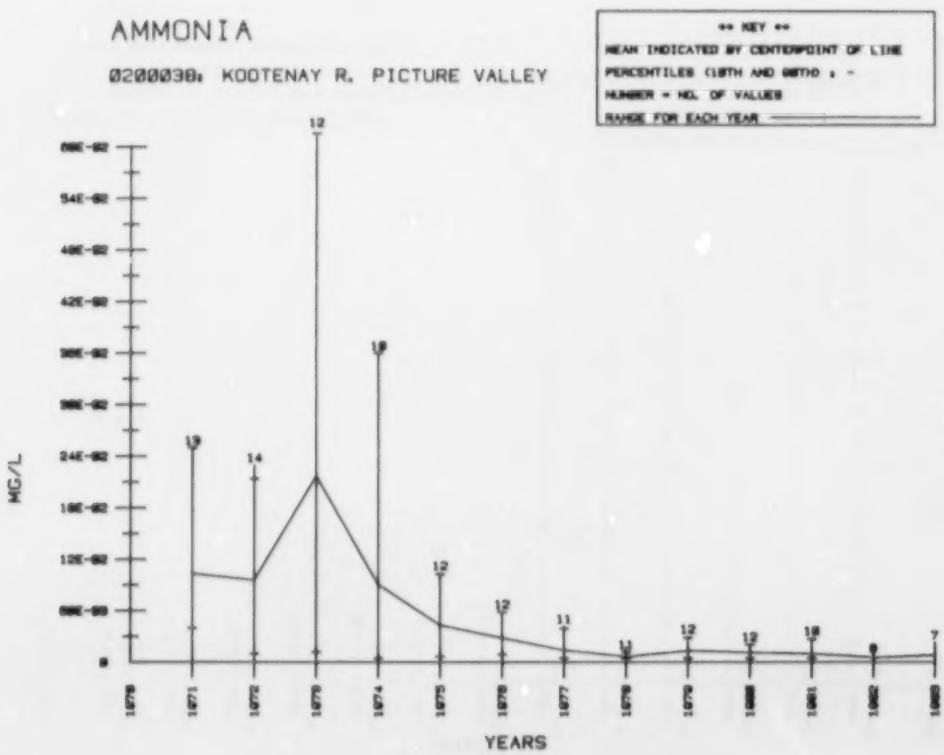
LAB PH

0200038: KOOTENAY R. PICTURE VALLEY


** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR
REL UNITS
9
8
7
6 12 11 17 14 11 11 12 12 18 8 8
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
YEARS

AMMONIA

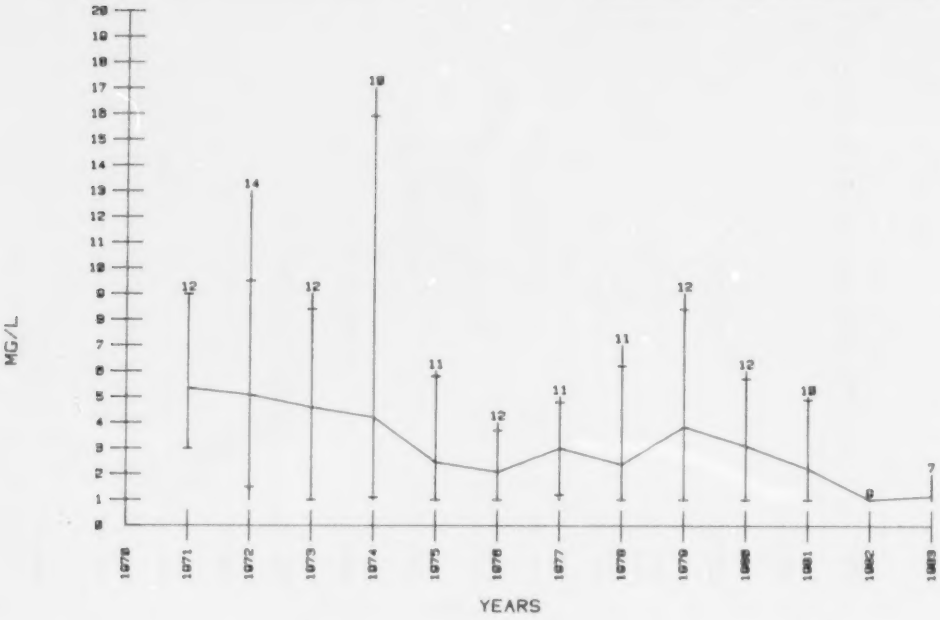
0200038: KOOTENAY R. PICTURE VALLEY


** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR
MG/L
12
19 14 19 12 12 11 11 12 12 18 9 7
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
YEARS

ORGANIC CARBON

0200038, KOOTENAY R. PICTURE VALLEY

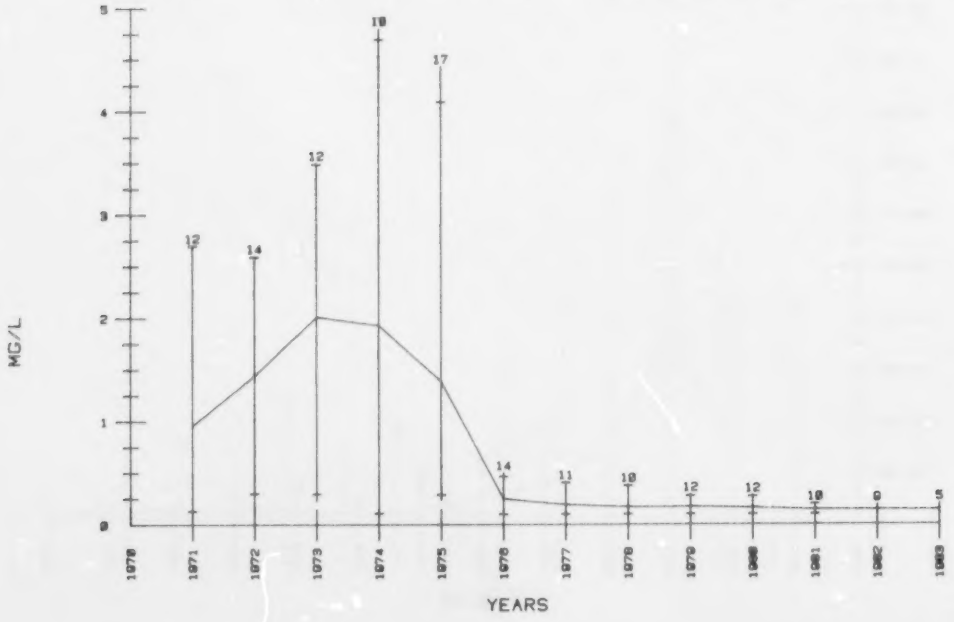
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) = -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——



FLUORIDE

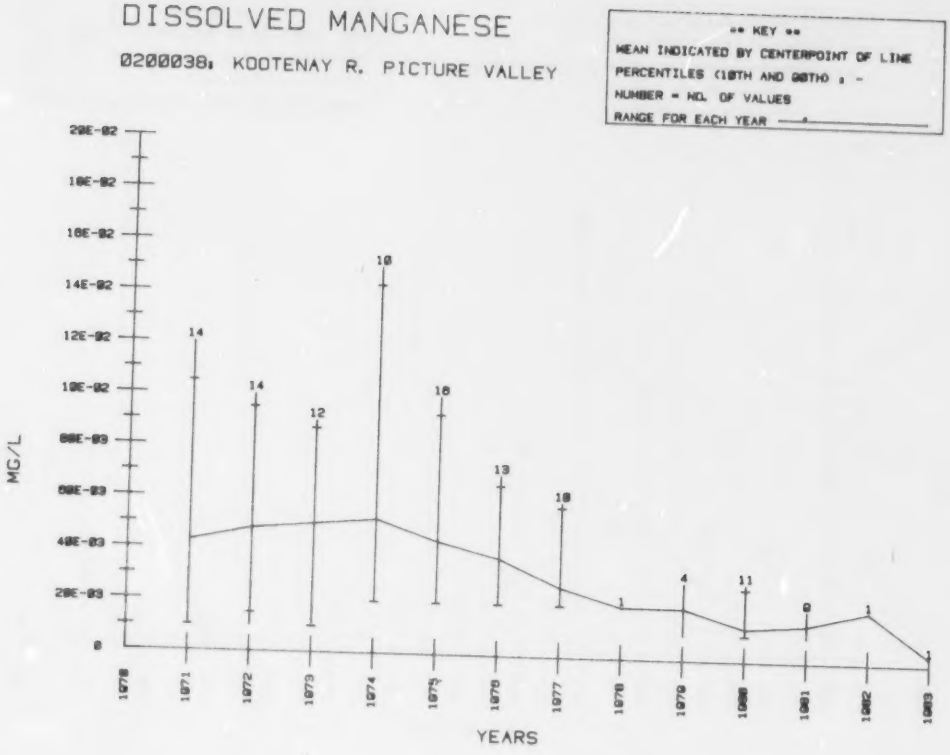
0200038, KOOTENAY R. PICTURE VALLEY

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) = -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——



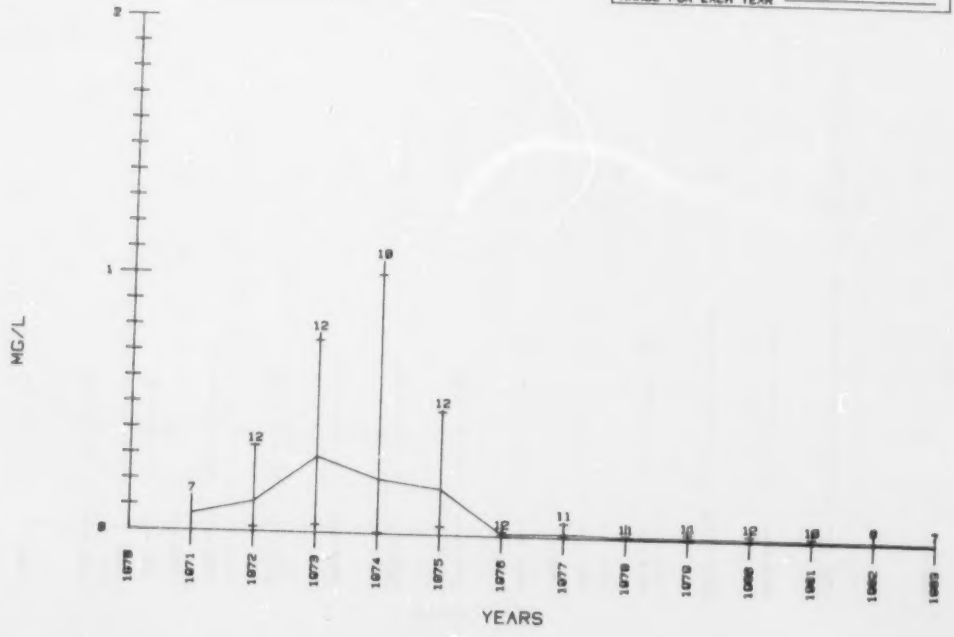
DISSOLVED MANGANESE

0200038: KOOTENAY R. PICTURE VALLEY



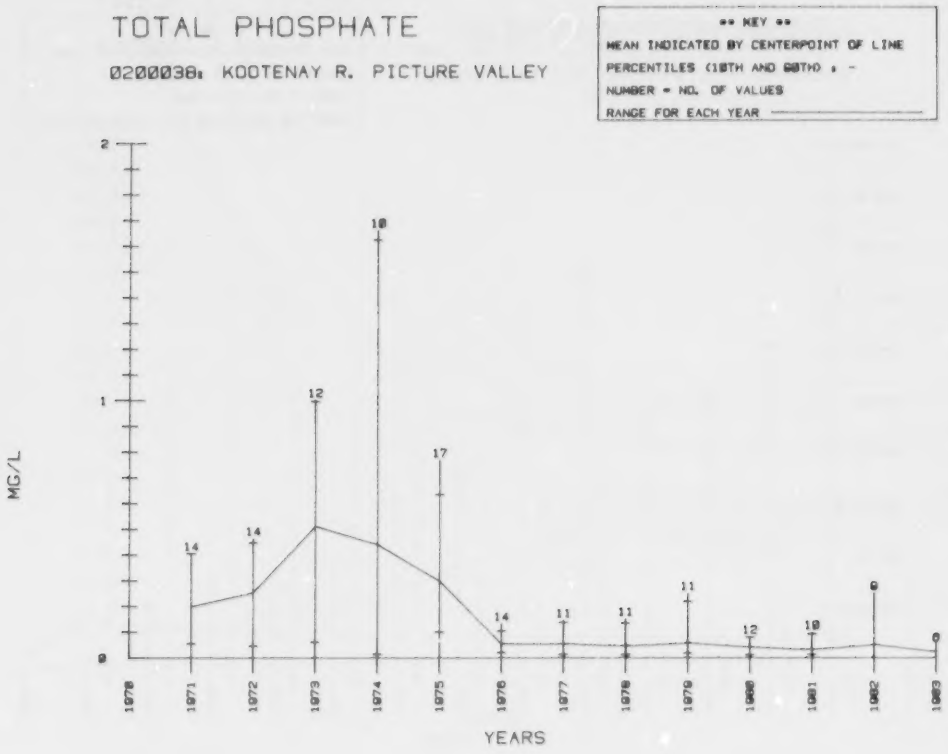
ORTHO PHOSPHATE

0200038: KOOTENAY R. PICTURE VALLEY



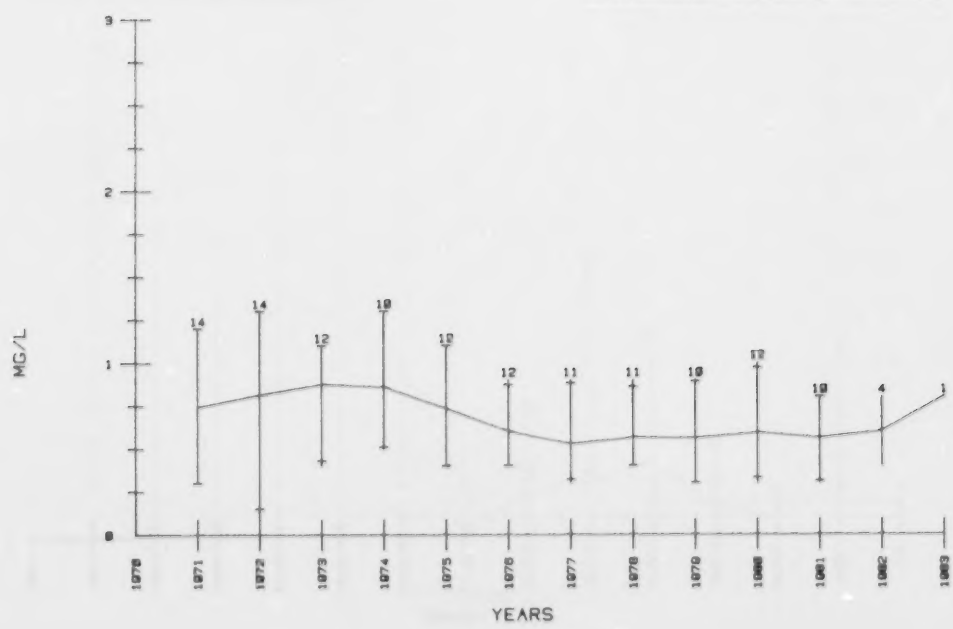
TOTAL PHOSPHATE

0200038: KOOTENAY R. PICTURE VALLEY



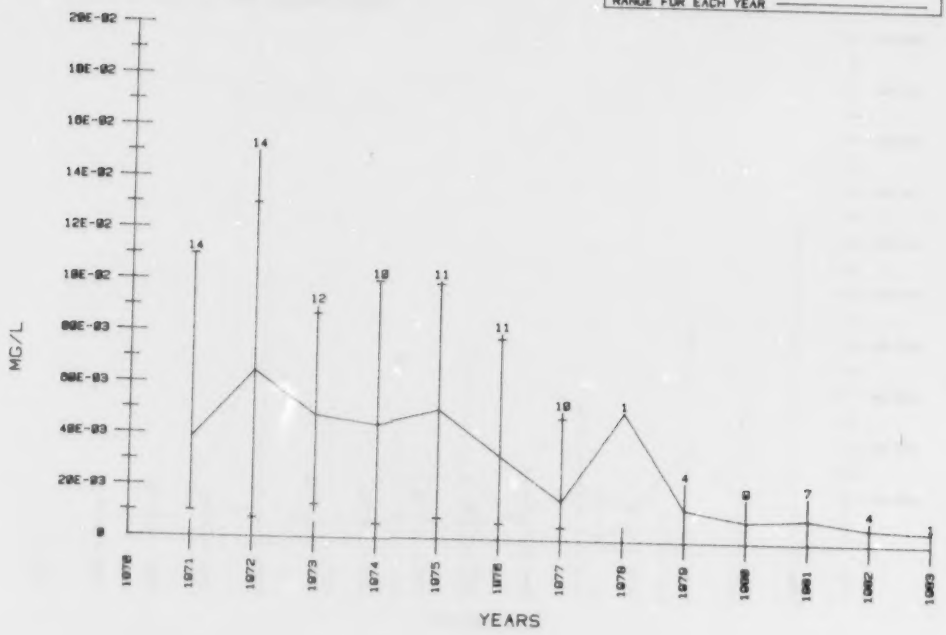
DISSOLVED POTASSIUM

0200038: KOOTENAY R. PICTURE VALLEY



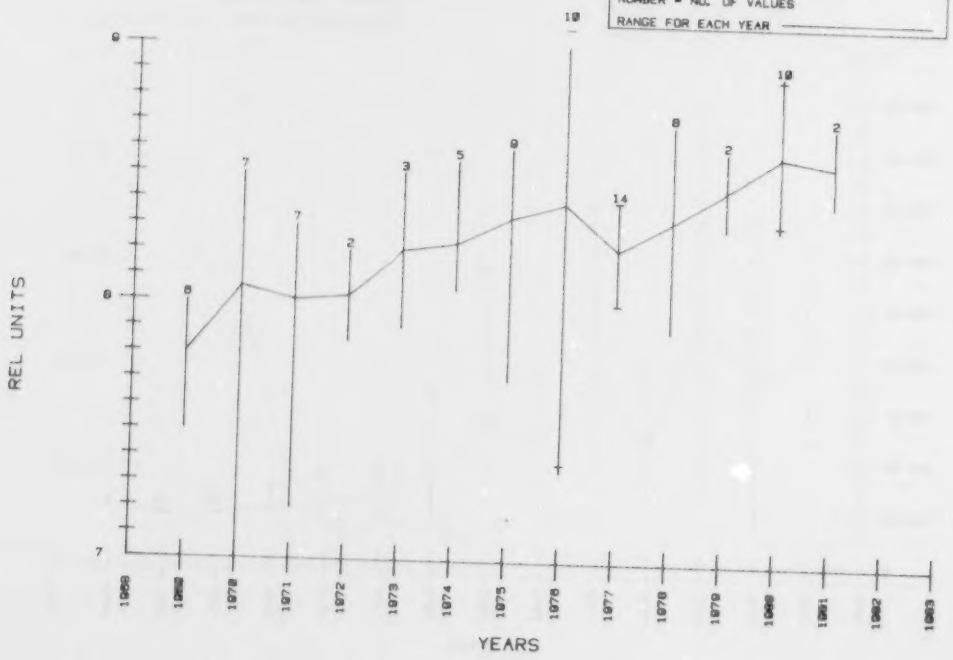
DISSOLVED ZINC

0200038: KOOTENAY R. PICTURE VALLEY



FIELD PH

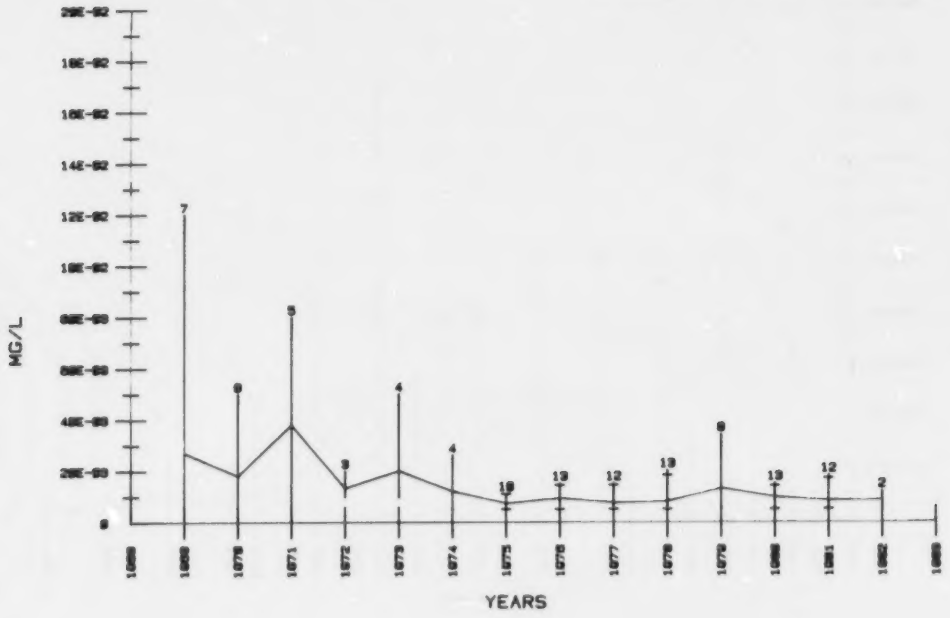
0200014: KOOTENAY R. PORTHILL



AMMONIA

0200014: KOOTENAY R. PORTHILL

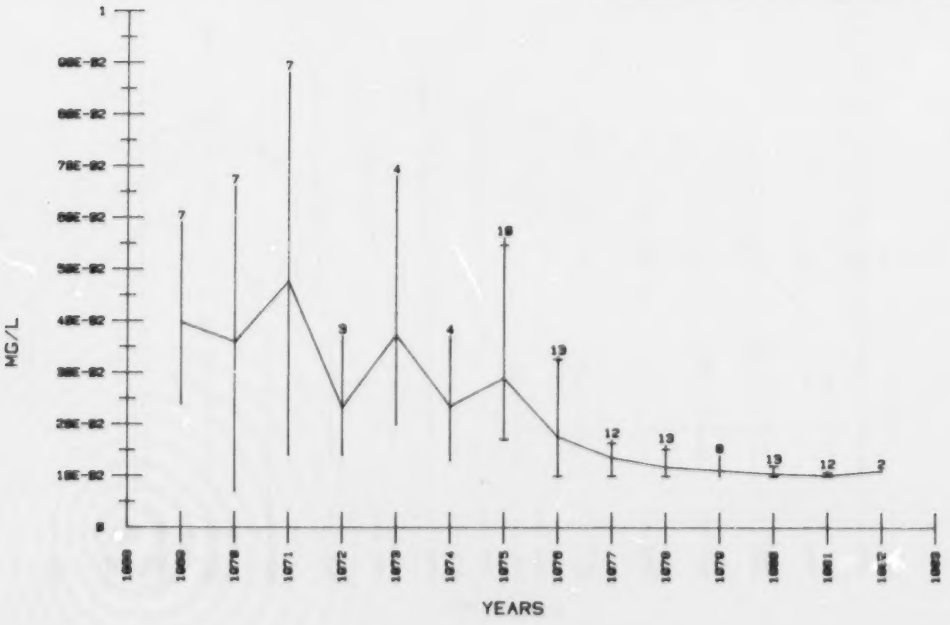
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR



FLUORIDE

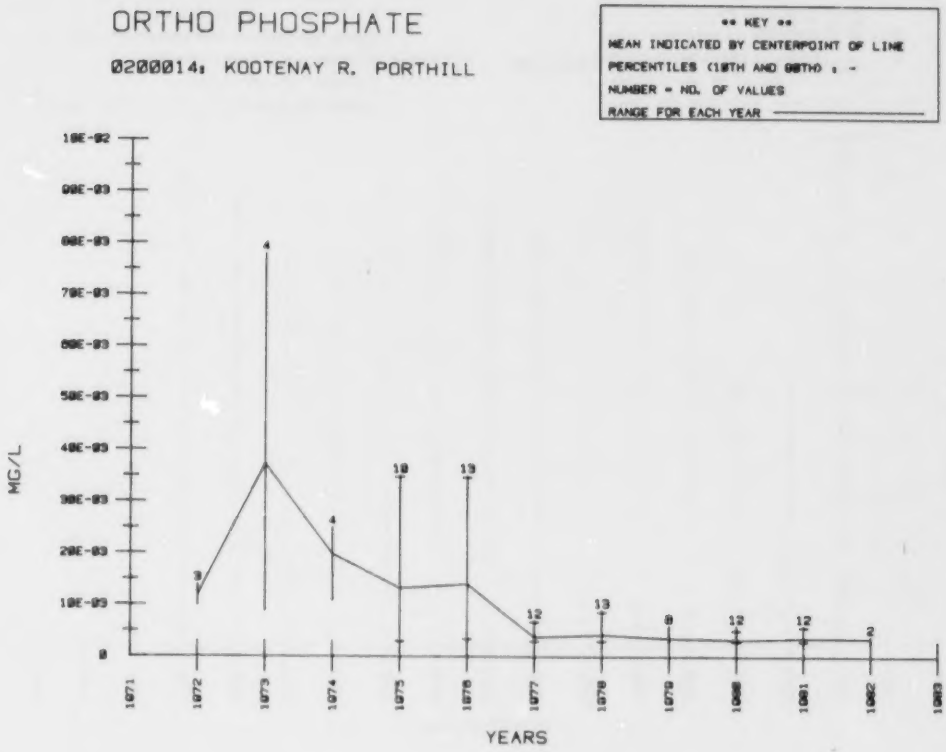
0200014: KOOTENAY R. PORTHILL

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR



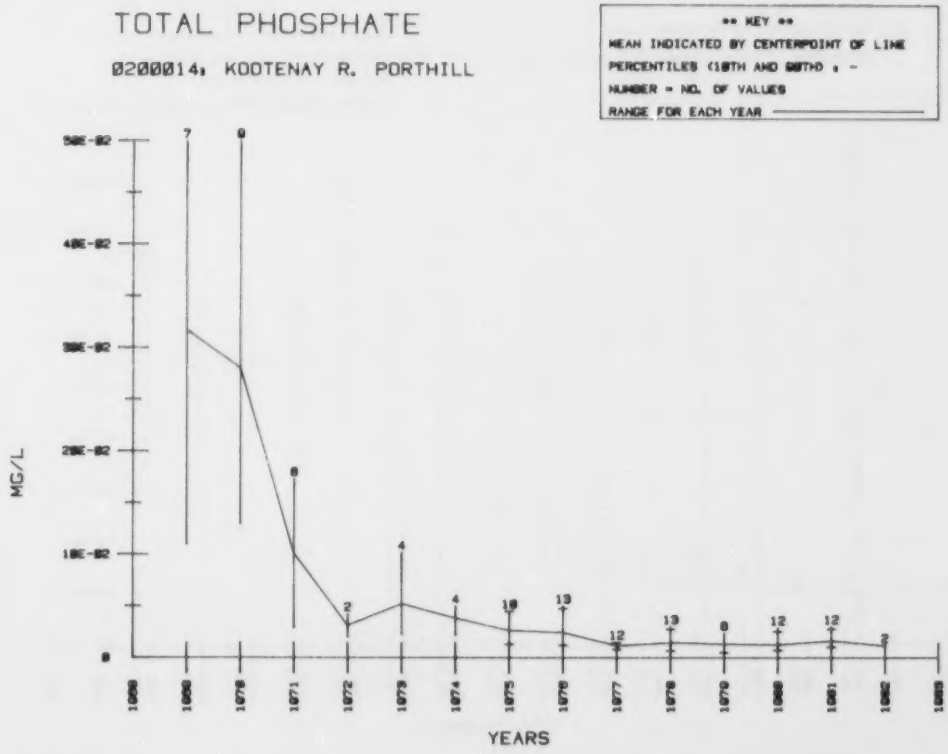
ORTHO PHOSPHATE

0200014: KOOTENAY R. PORTHILL



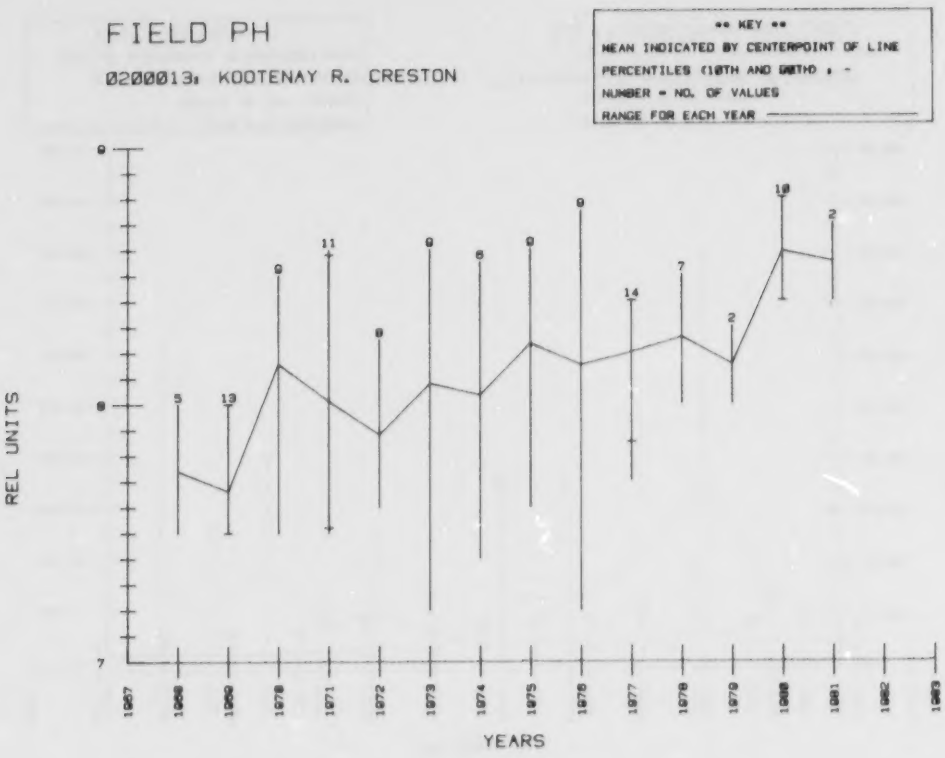
TOTAL PHOSPHATE

0200014: KOOTENAY R. PORTHILL



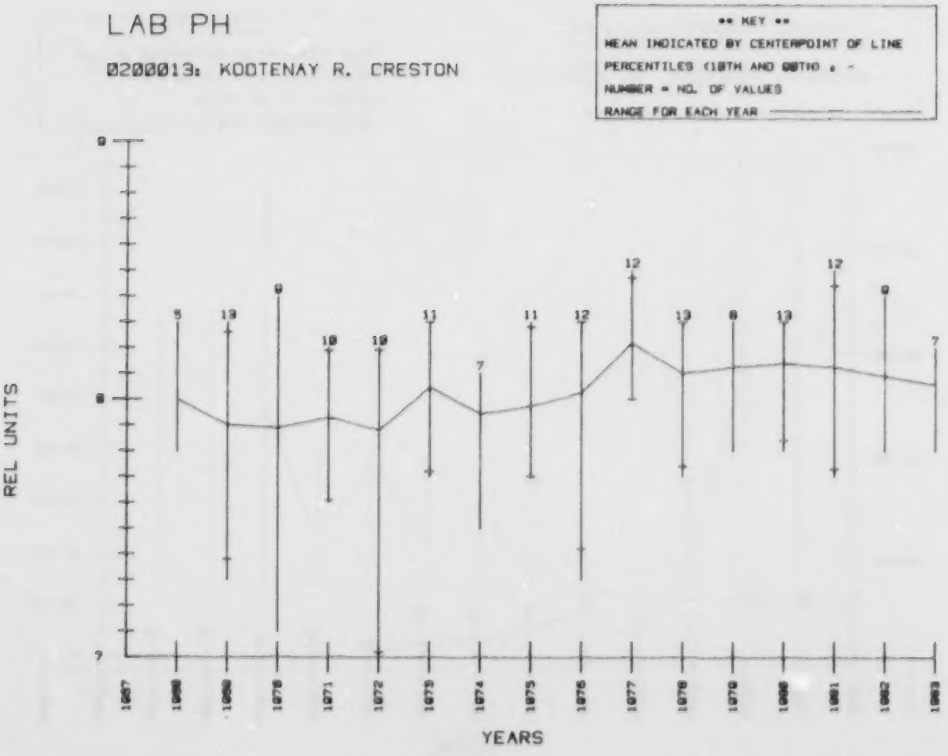
FIELD PH

0200013: KOOTENAY R. CRESTON



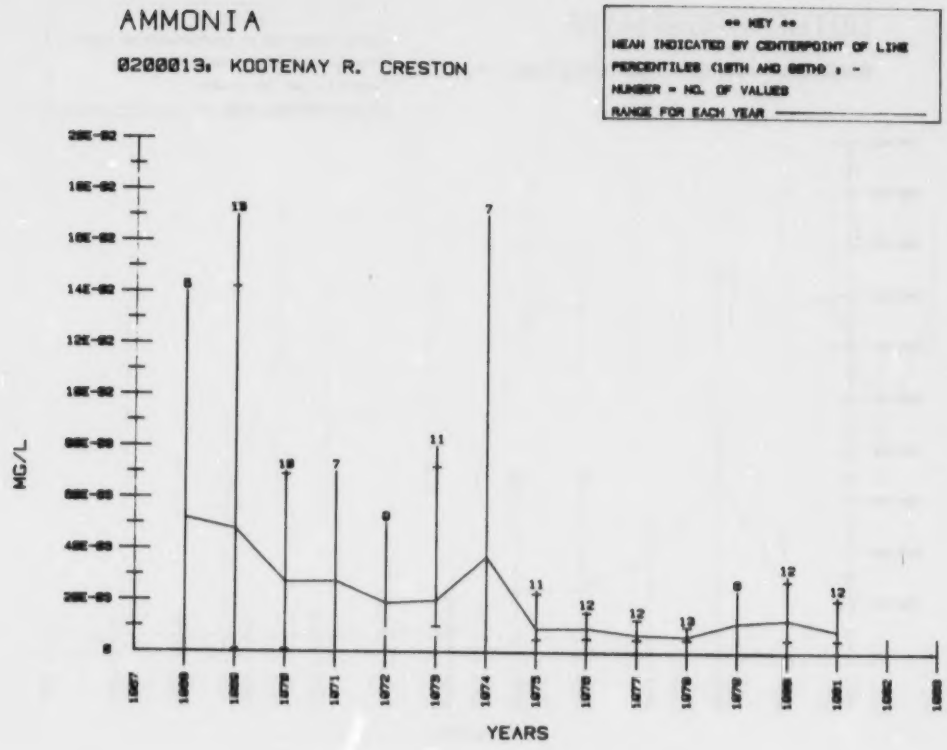
LAB PH

0200013: KOOTENAY R. CRESTON



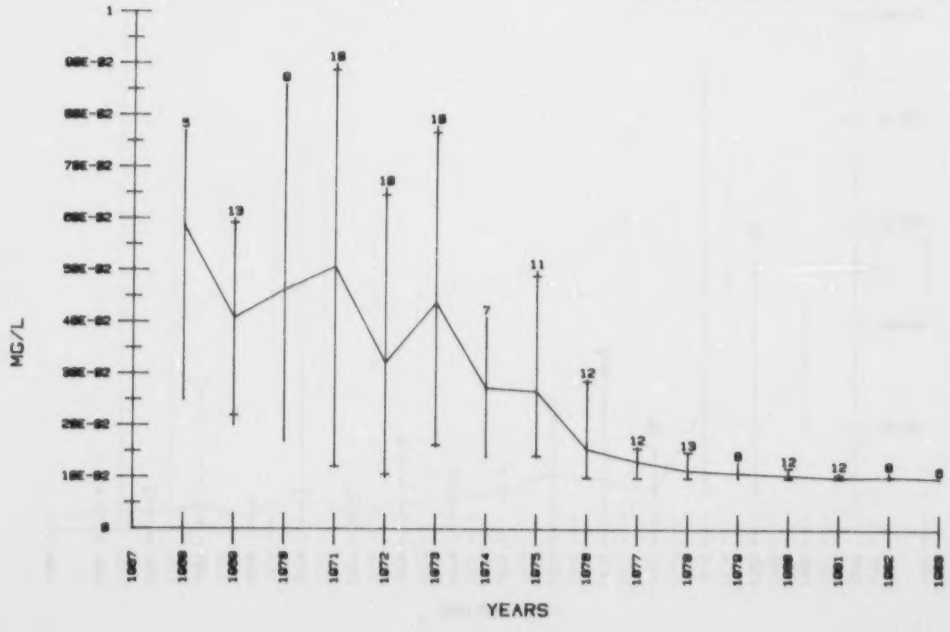
AMMONIA

0200013: KOOTENAY R. CRESTON



FLUORIDE

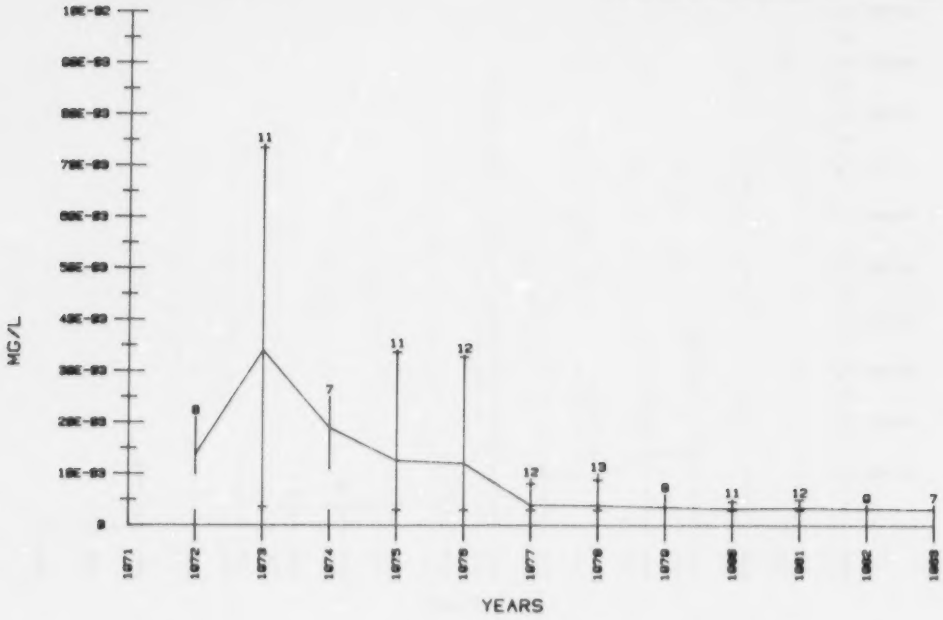
0200013: KOOTENAY R. CRESTON



ORTHO PHOSPHATE

0200013: KOOTENAY R. CRESTON

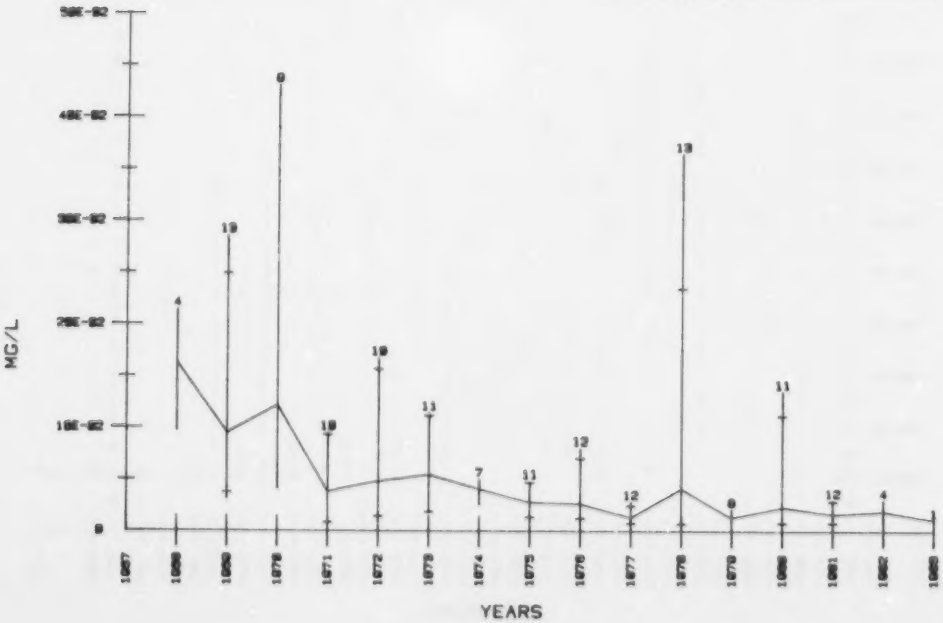
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————



TOTAL PHOSPHATE

0200013: KOOTENAY R. CRESTON

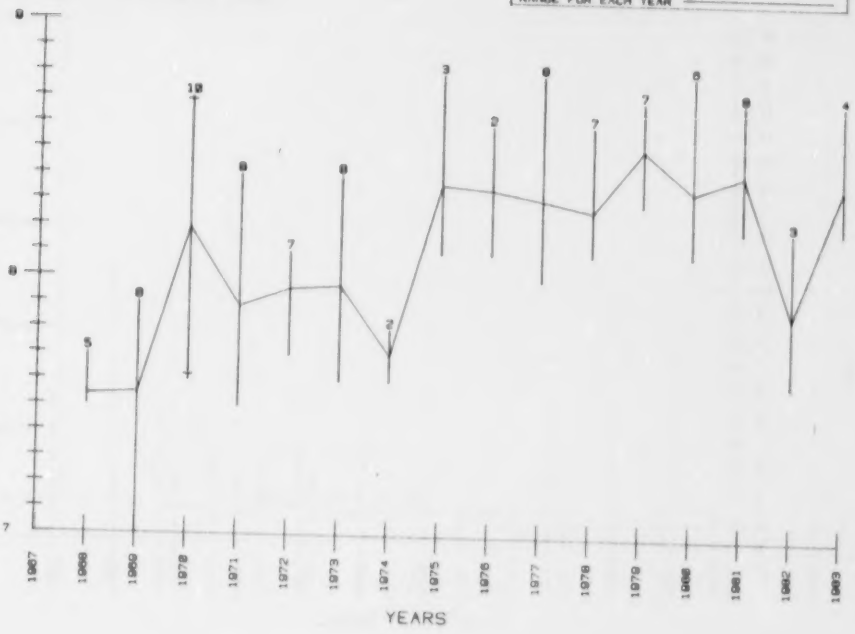
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————



FIELD PH

0200012: KOOTENAY R. FRASER RAPIDS

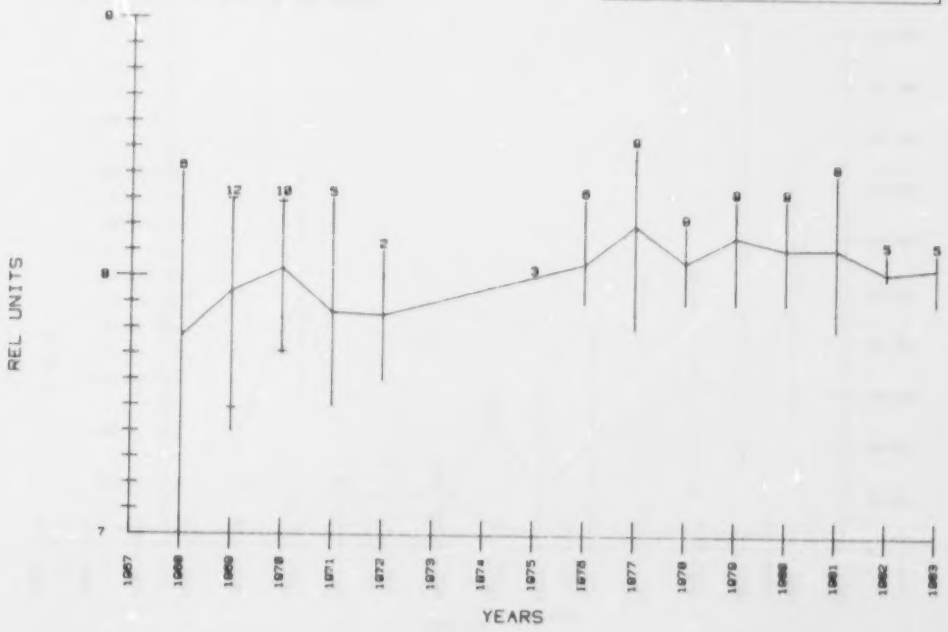
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) = -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——



LAB PH

0200012: KOOTENAY R. FRASER RAPIDS

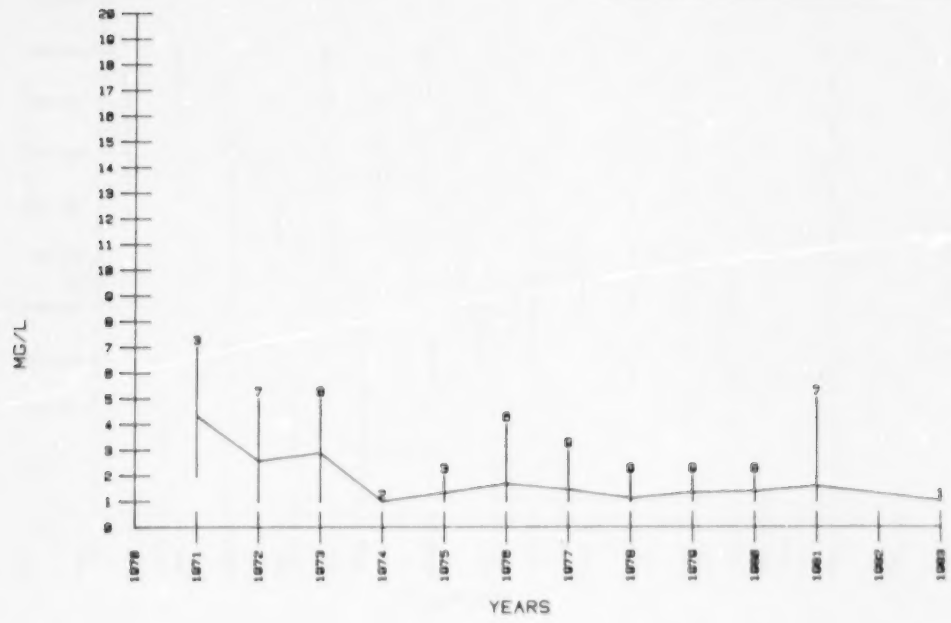
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) = -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——



ORGANIC CARBON

0200012: KOOTENAY R. FRASER RAPIDS

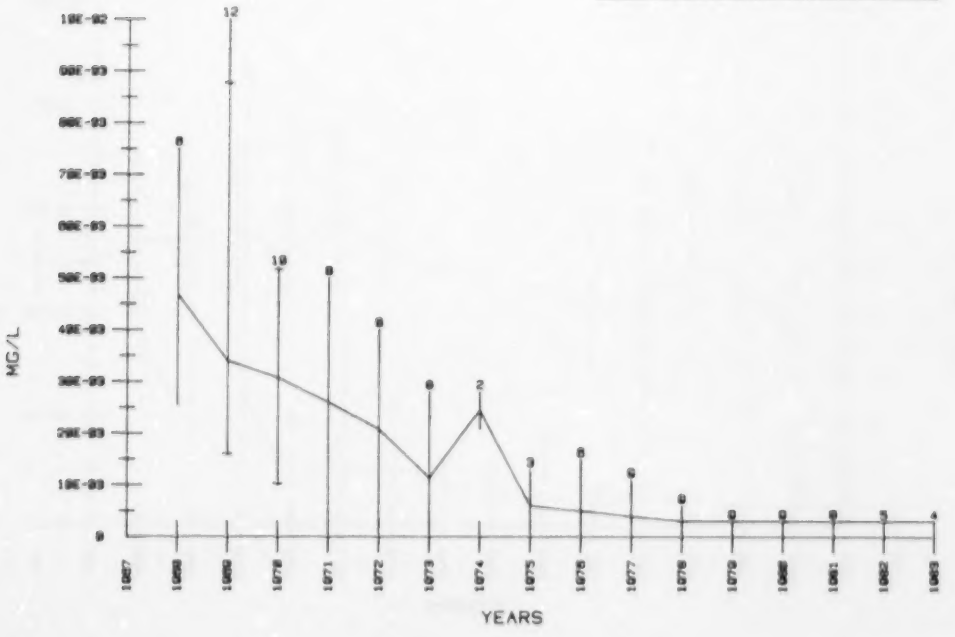
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————



ORTHO PHOSPHATE

0200012: KOOTENAY R. FRASER RAPIDS

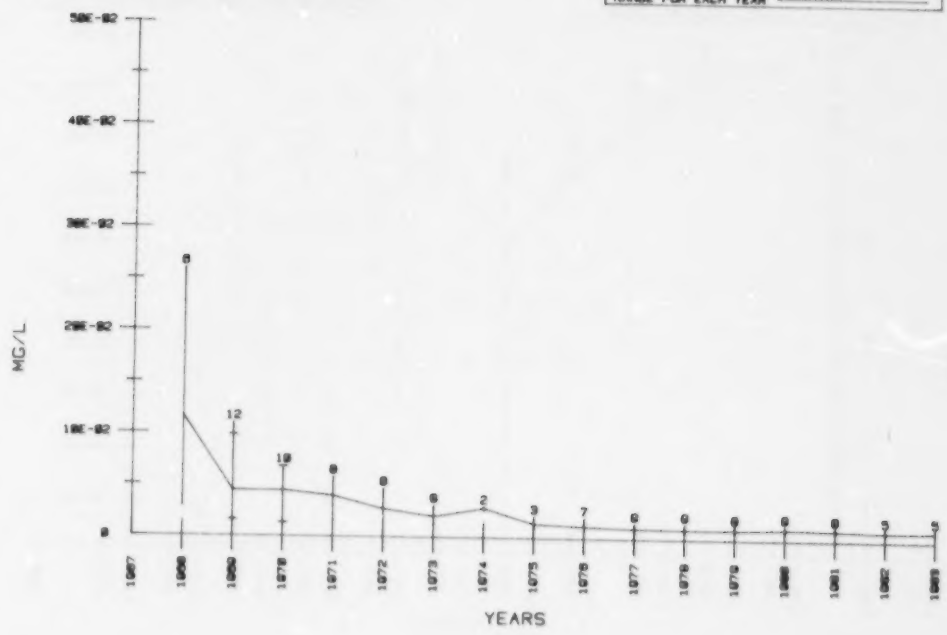
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————



TOTAL PHOSPHATE

0200012: KOOTENAY R. FRASER RAPIDS

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——

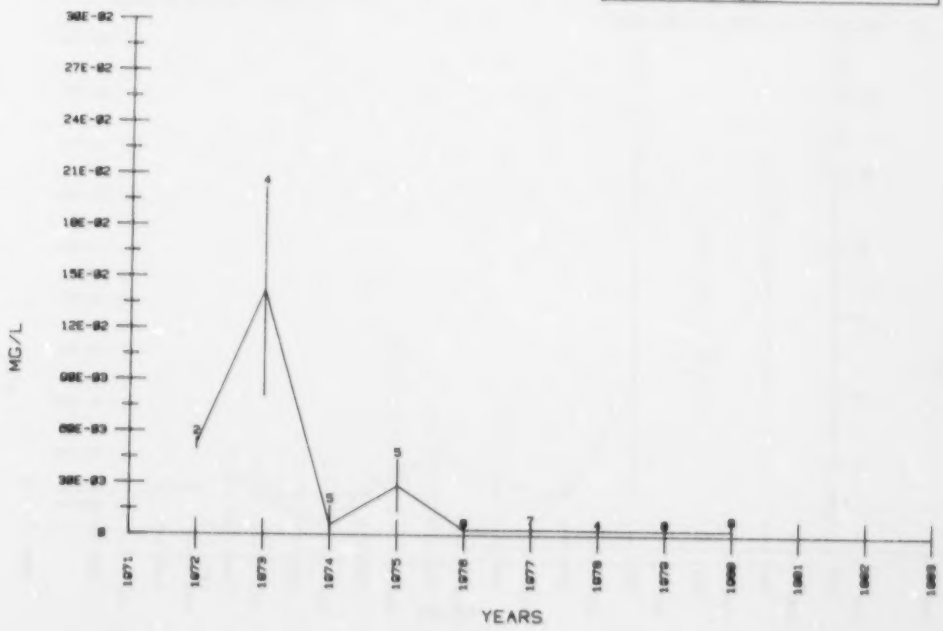


ORTHO PHOSPHATE

0200101: LK KOOCANUSA - CONFL. OF ELK

DEPTH: 0 TO 5 M

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——

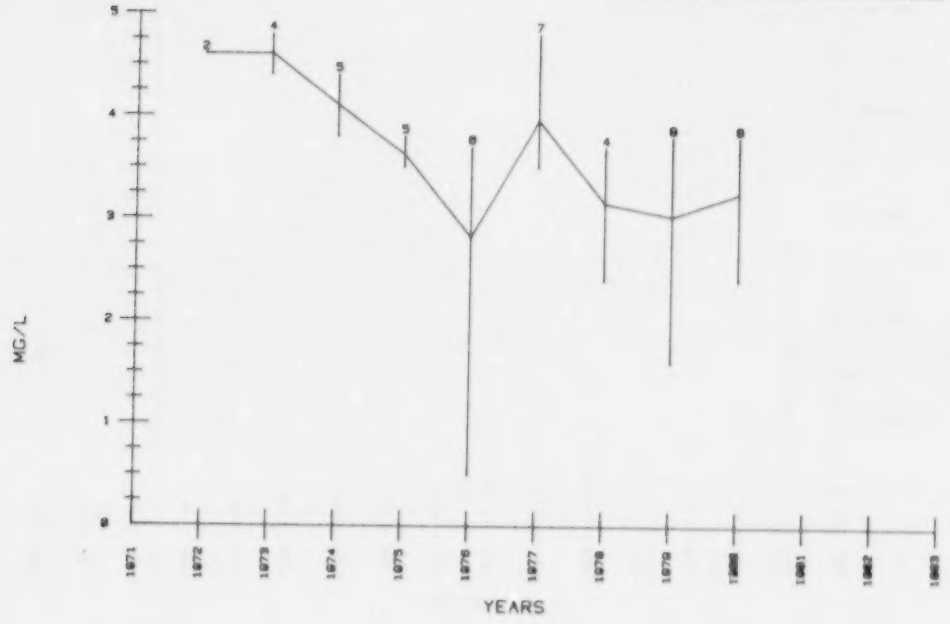


SILICA

0200101: LK KOOCANUSA - CONFL. OF ELK

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

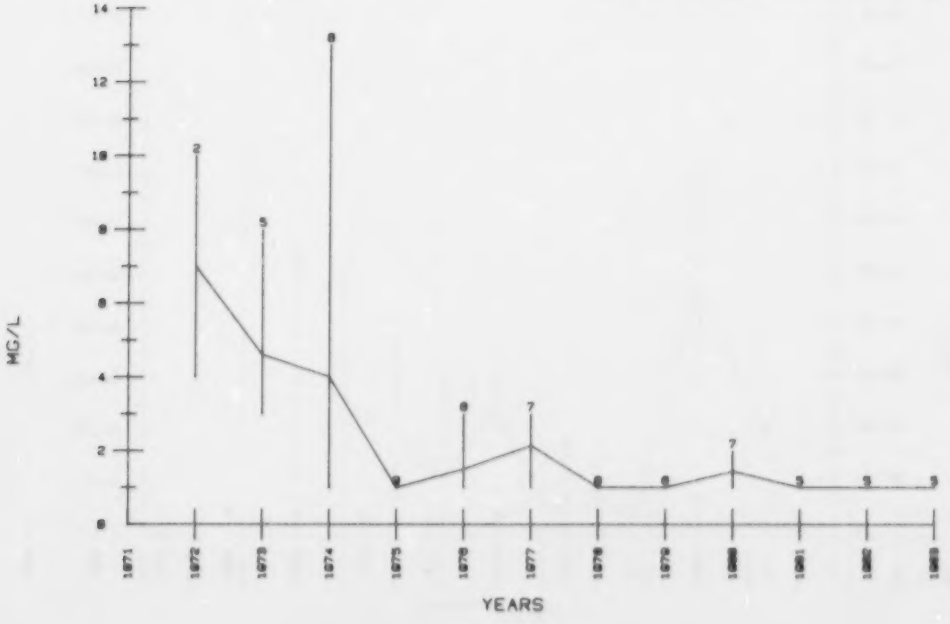


ORGANIC CARBON

0200100: LAKE KOOCANUSA - INT. BORDER

DEPTH: 0 TO 5 M.

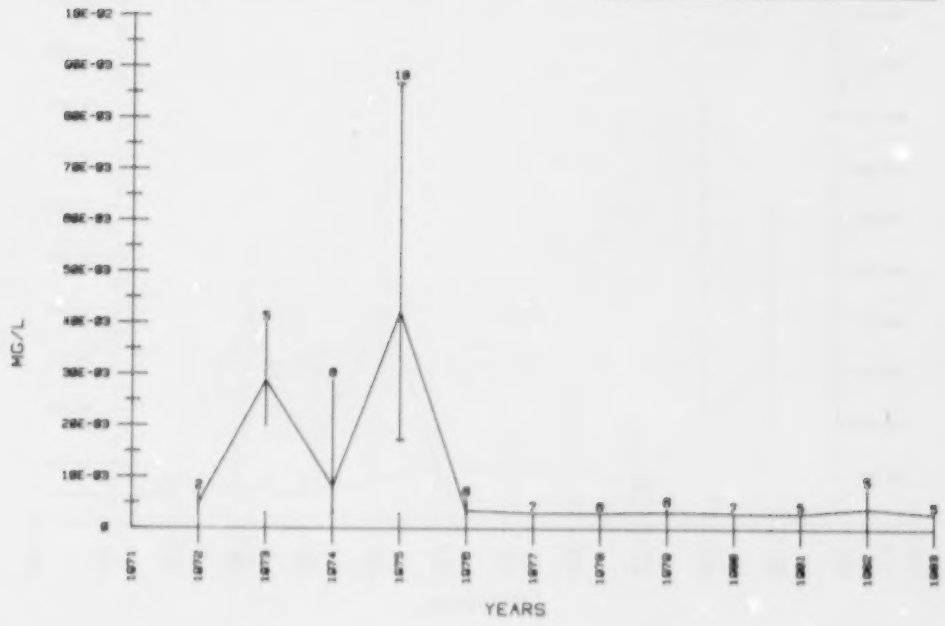
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————



ORTHO PHOSPHATE

0200100: LAKE KOOCANUSA - INT. BORDER

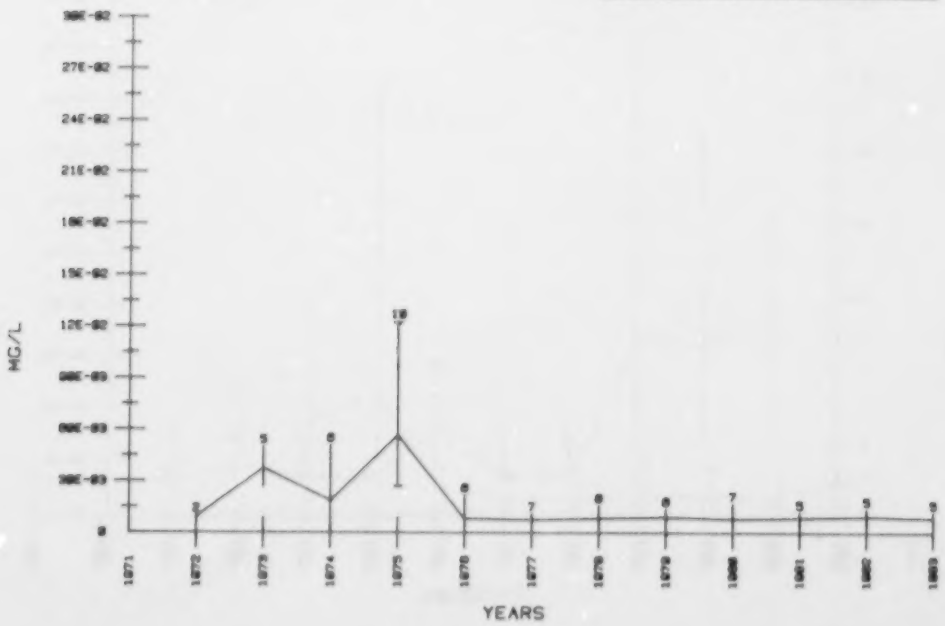
DEPTH: 0 TO 5 M.



TOTAL PHOSPHATE

0200100: LAKE KOOCANUSA - INT. BORDER

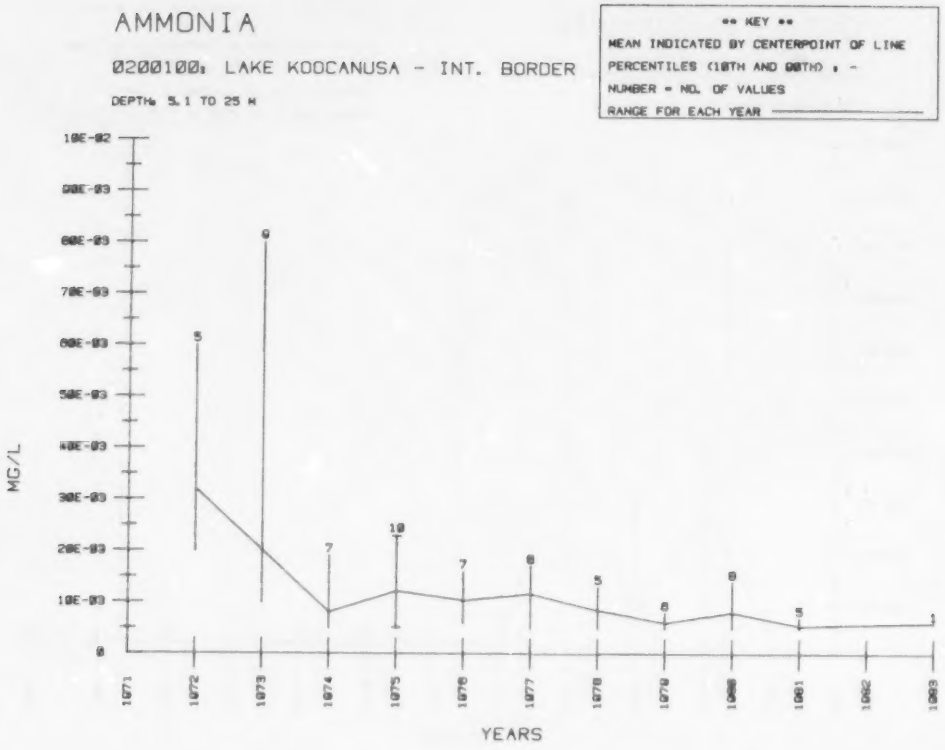
DEPTH: 0 TO 5 M.



AMMONIA

0200100: LAKE KOOCANUSA - INT. BORDER

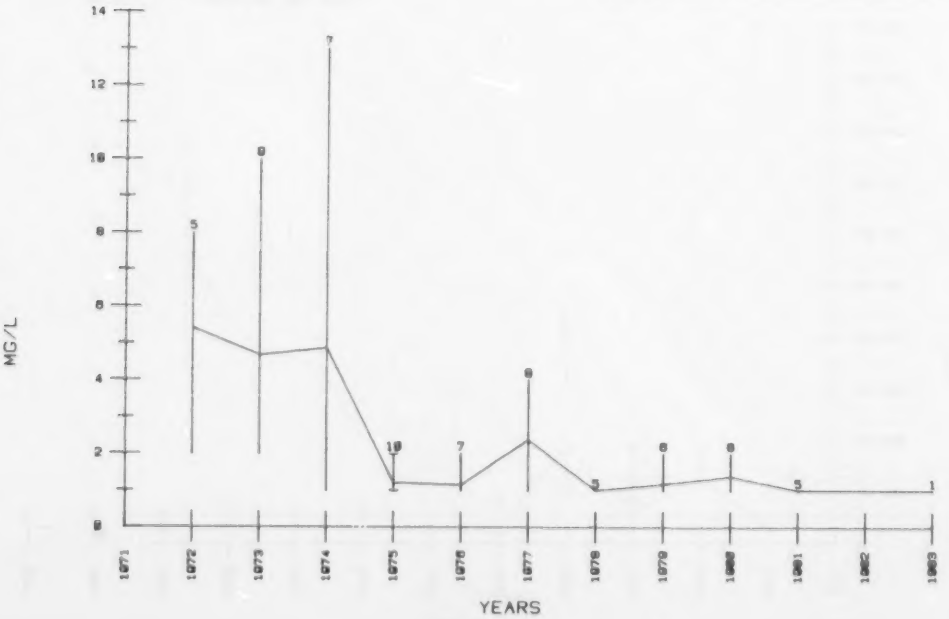
DEPTH: 5.1 TO 25 M



ORGANIC CARBON

0200100: LAKE KOOCANUSA - INT. BORDER

DEPTH: 5.1 TO 25 M

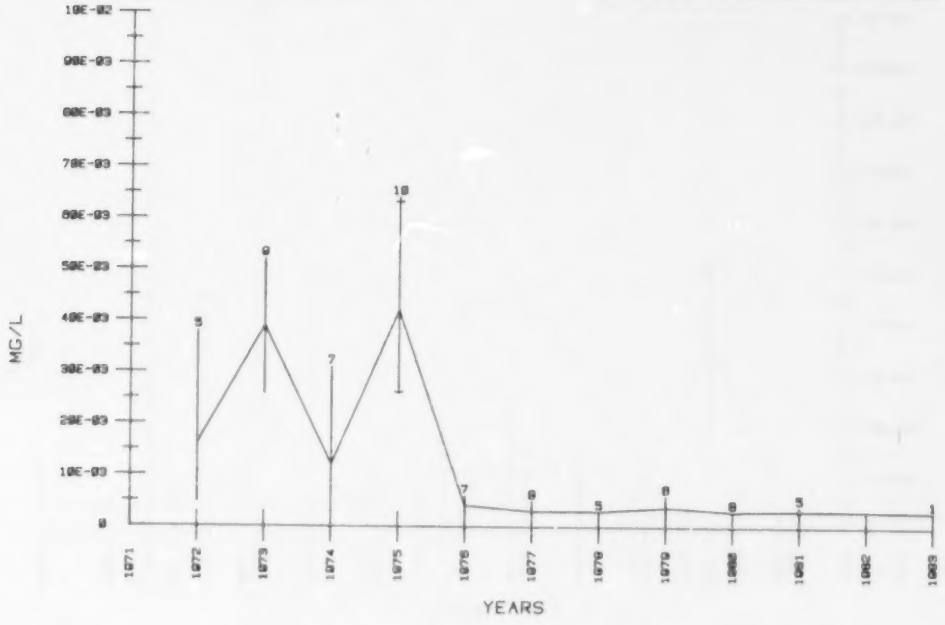


ORTHO PHOSPHATE

0200100: LAKE KOOCANUSA - INT. BORDER

DEPTH: 5.1 TO 25 M

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

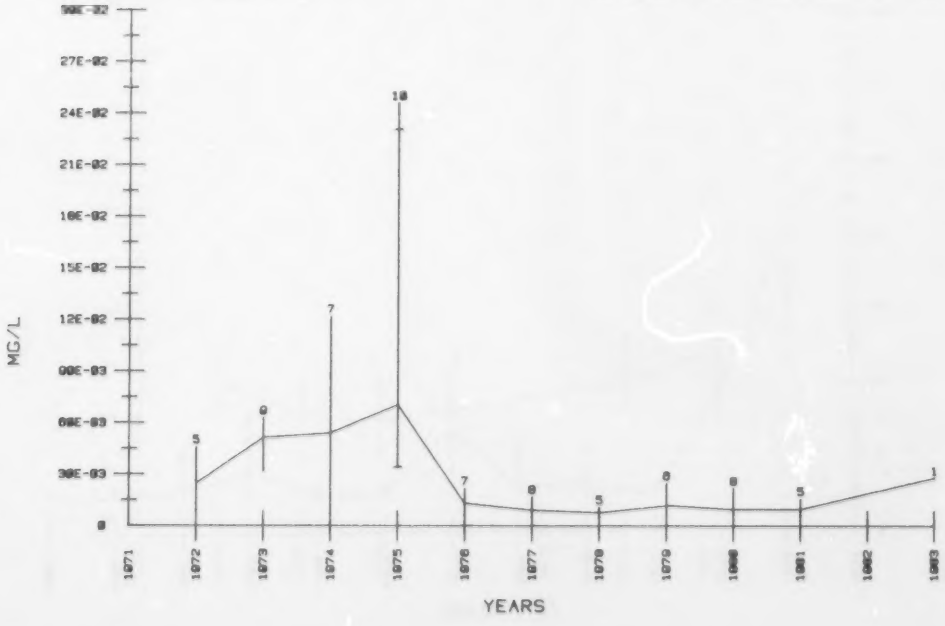


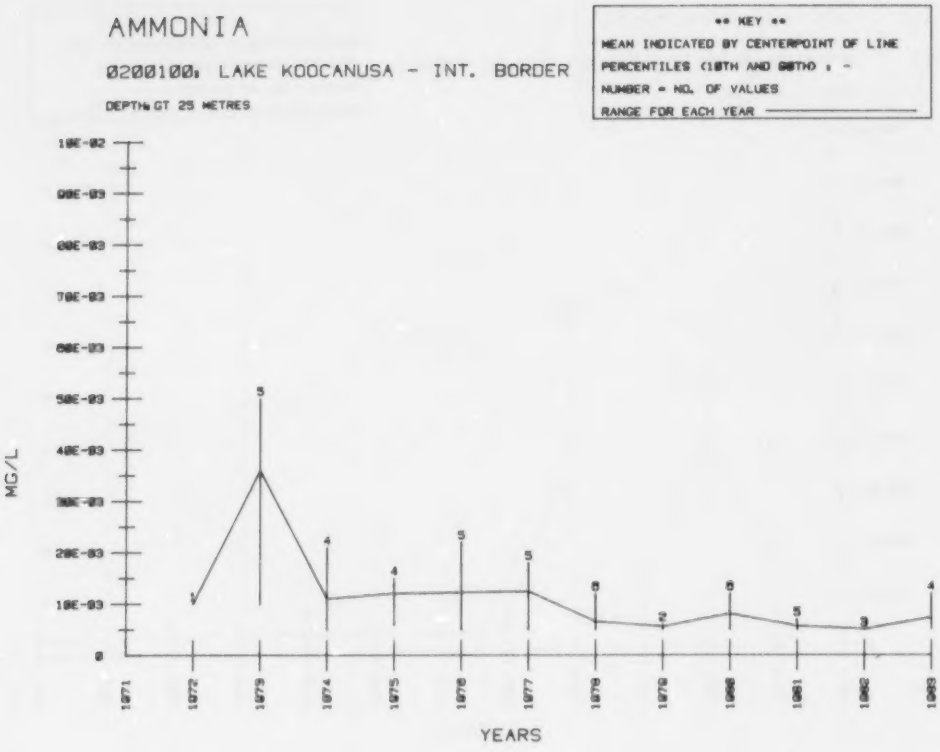
TOTAL PHOSPHATE

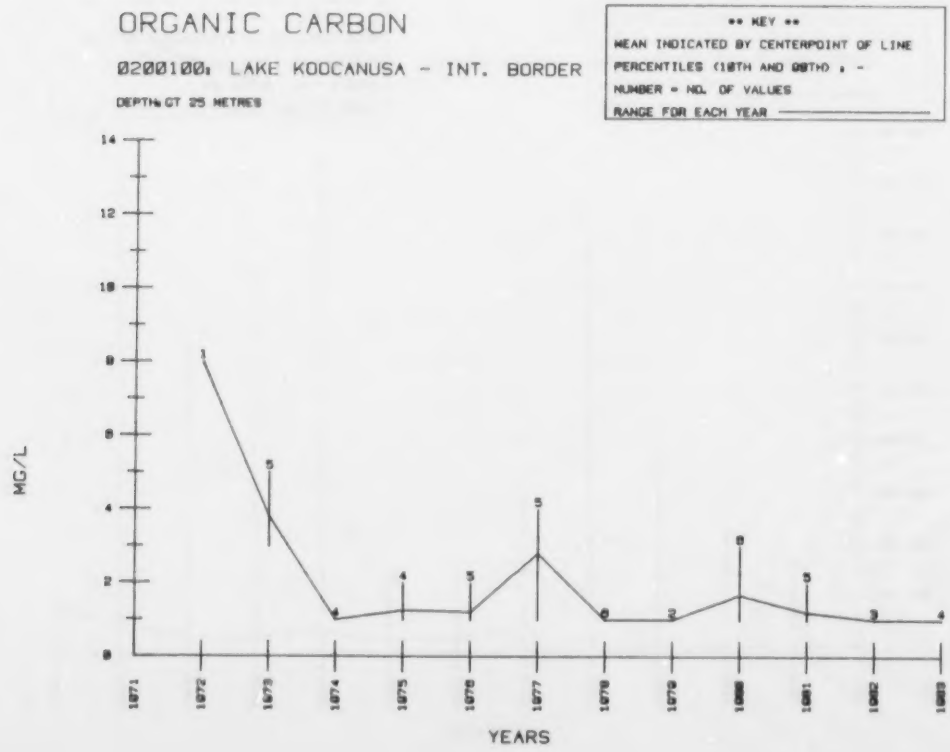
0200100: LAKE KOOCANUSA - INT. BORDER

DEPTH: 5.1 TO 25 M

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————



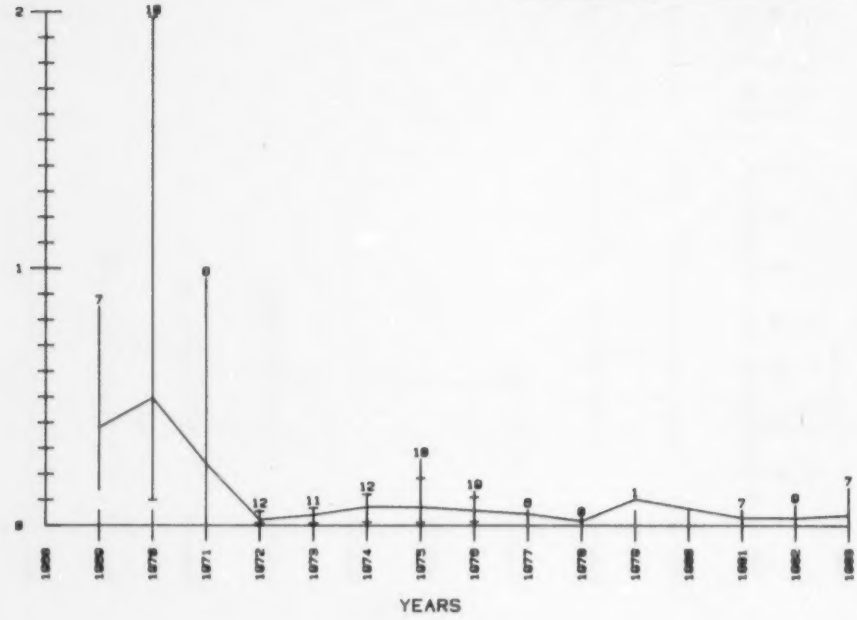

AMMONIA
0200100: LAKE KOOCANUSA - INT. BORDER
DEPTH: GT 25 METRES
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR
MG/L
YEARS


ORGANIC CARBON
0200100: LAKE KOOCANUSA - INT. BORDER
DEPTH: GT 25 METRES
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR
MG/L
YEARS

AMMONIA

0200025: MICHEL CR. NATAL

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——

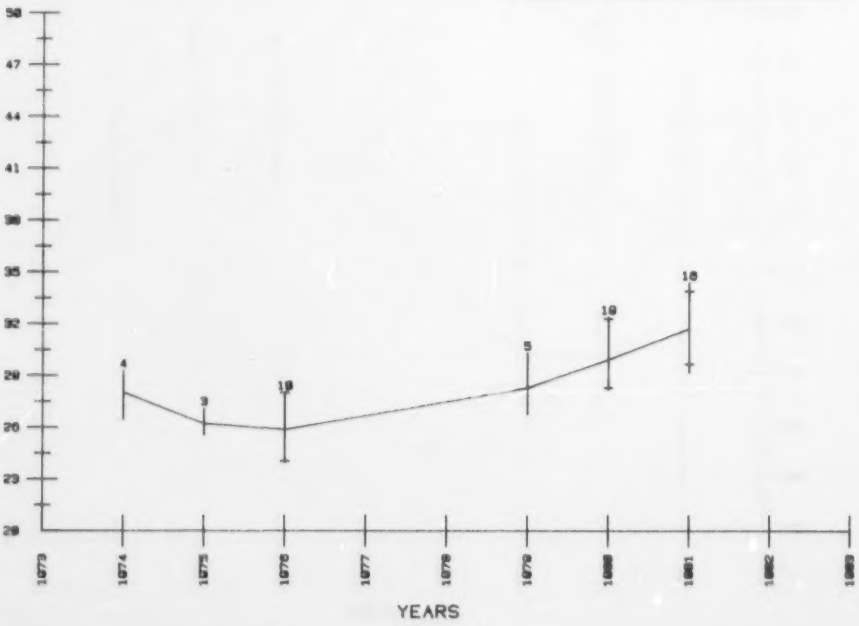


TOTAL ALKALINITY

1100104: ST. MARY LAKE NORTH END

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——

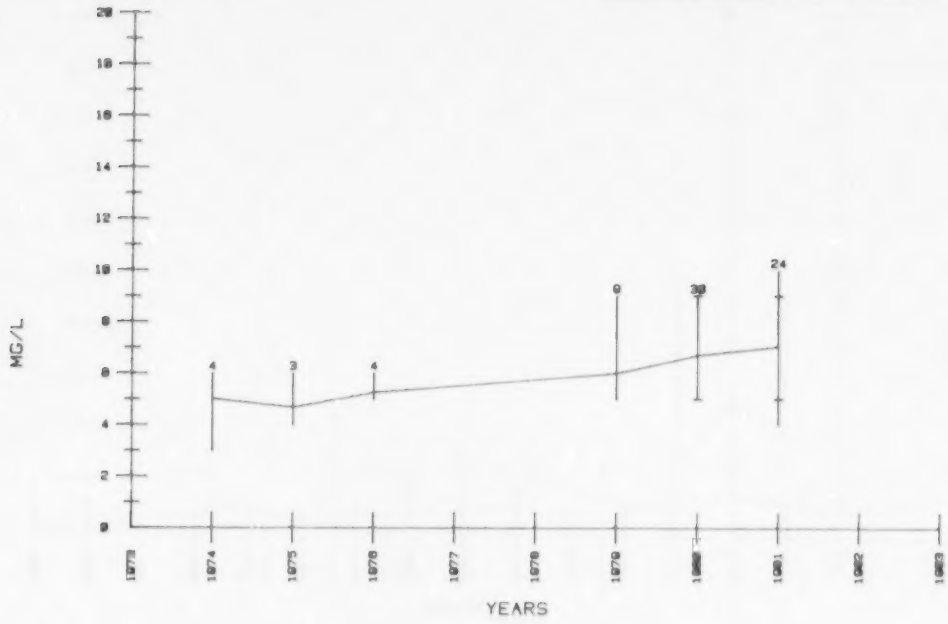


INORGANIC CARBON

1100104: ST. MARY LAKE NORTH END

DEPTH: 0 TO 5 M.

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————

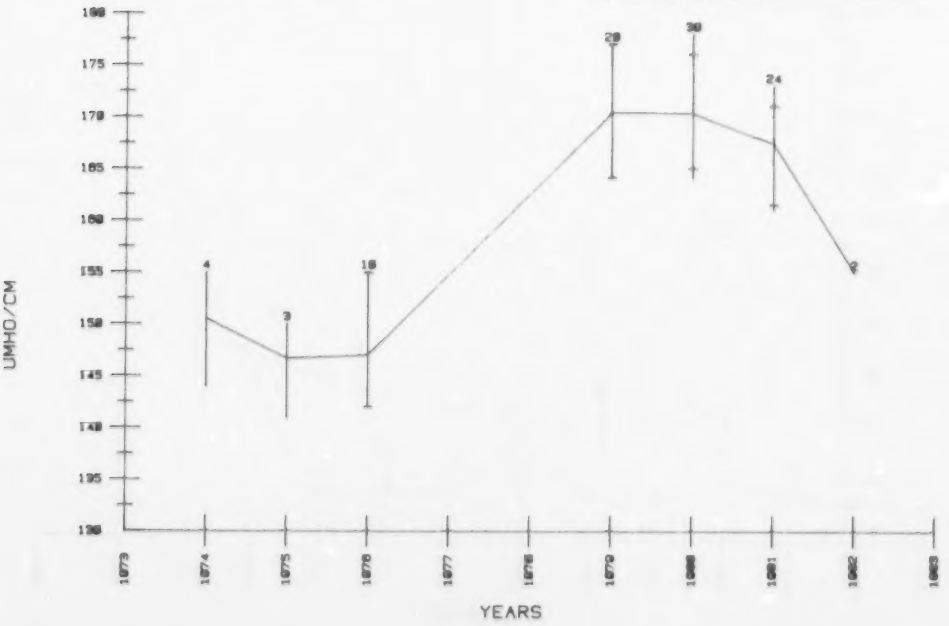


LAB SPECIFIC COND.

1100104: ST. MARY LAKE NORTH END

DEPTH: 0 TO 5 M.

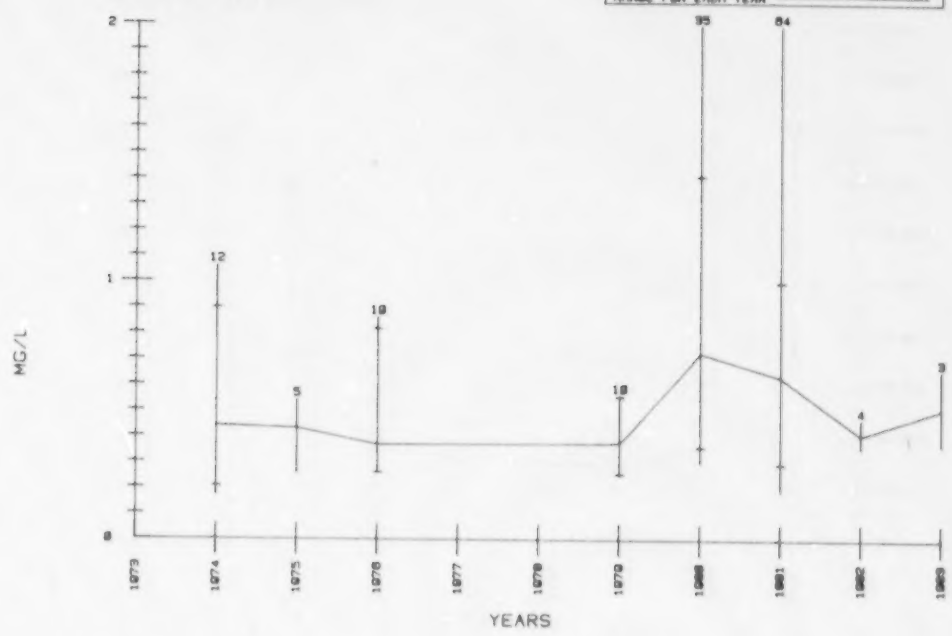
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) : -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ——————



KJELDAHL NITROGEN

1100104: ST. MARY LAKE NORTH END

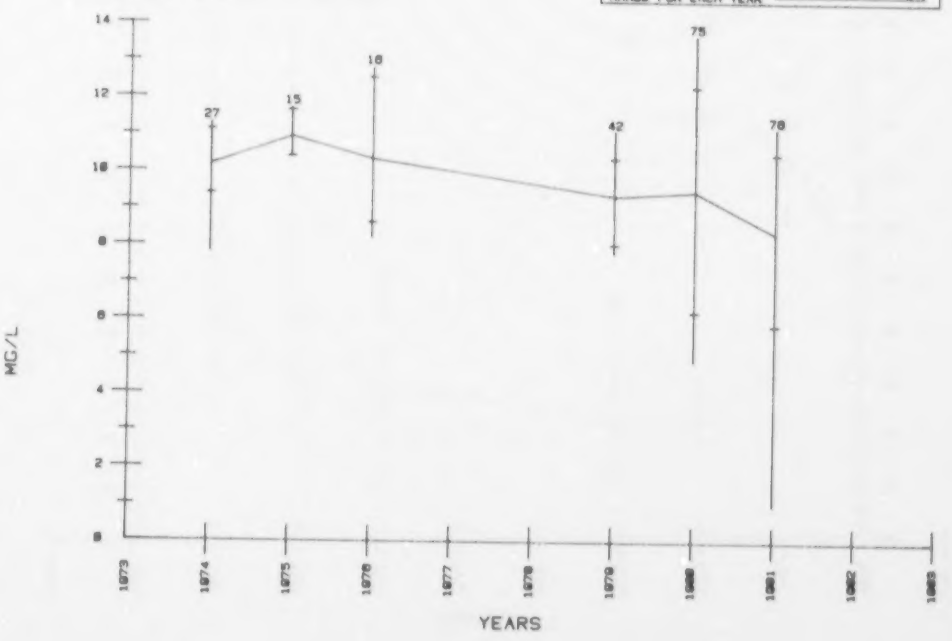
DEPTH: 5.1 TO 25 M



DISSOLVED OXYGEN

1100104: ST. MARY LAKE NORTH END

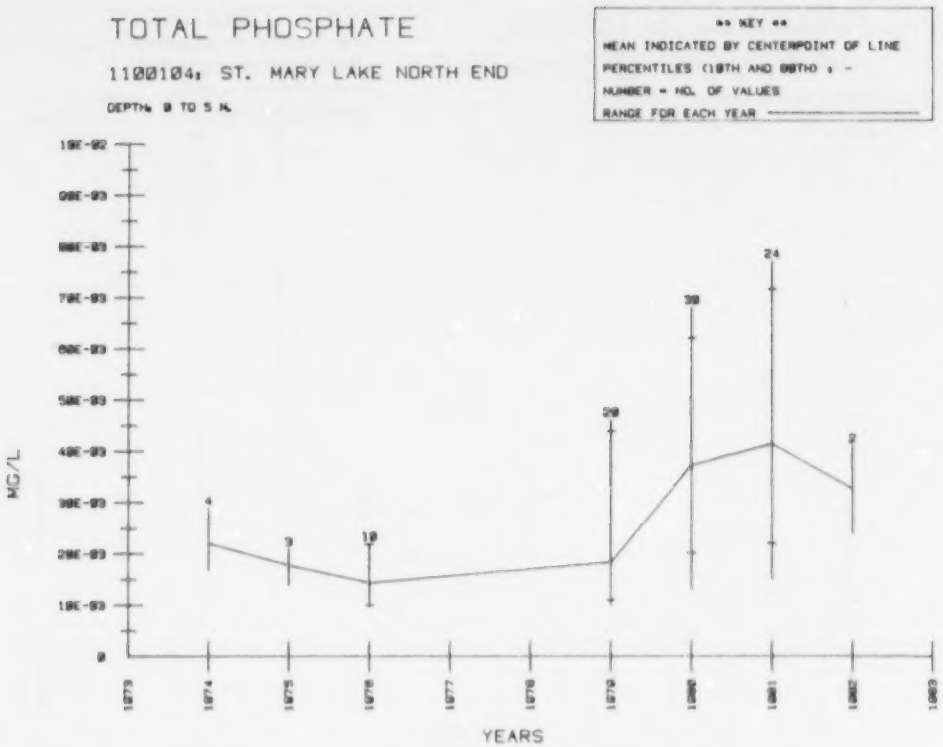
DEPTH: 0 TO 5 M



TOTAL PHOSPHATE

1100104: ST. MARY LAKE NORTH END

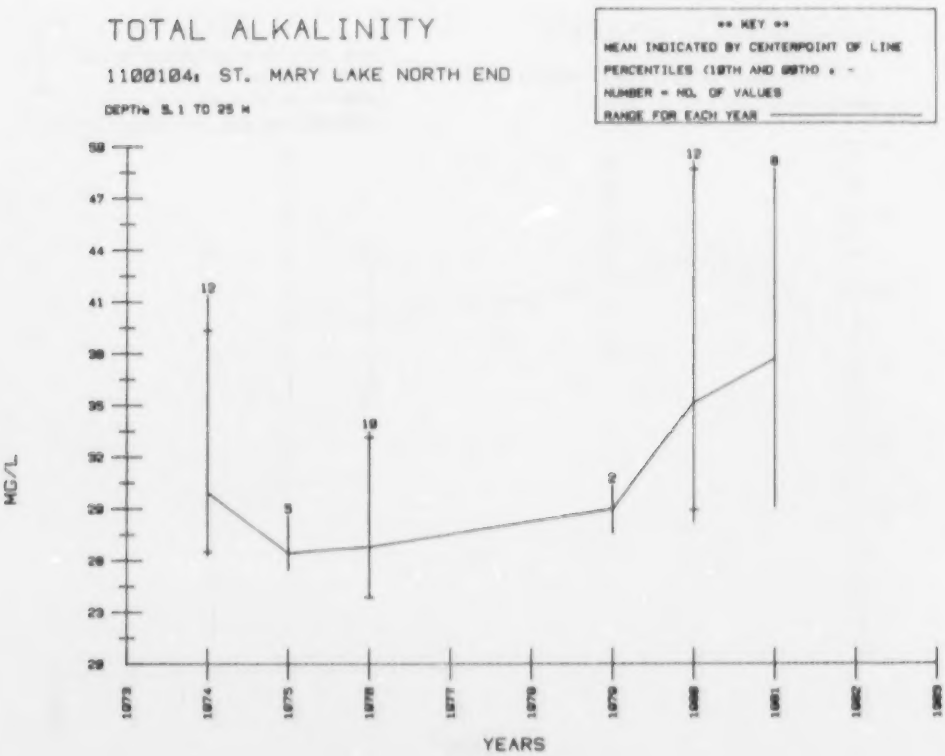
DEPTH: 0 TO 5 M.



TOTAL ALKALINITY

1100104: ST. MARY LAKE NORTH END

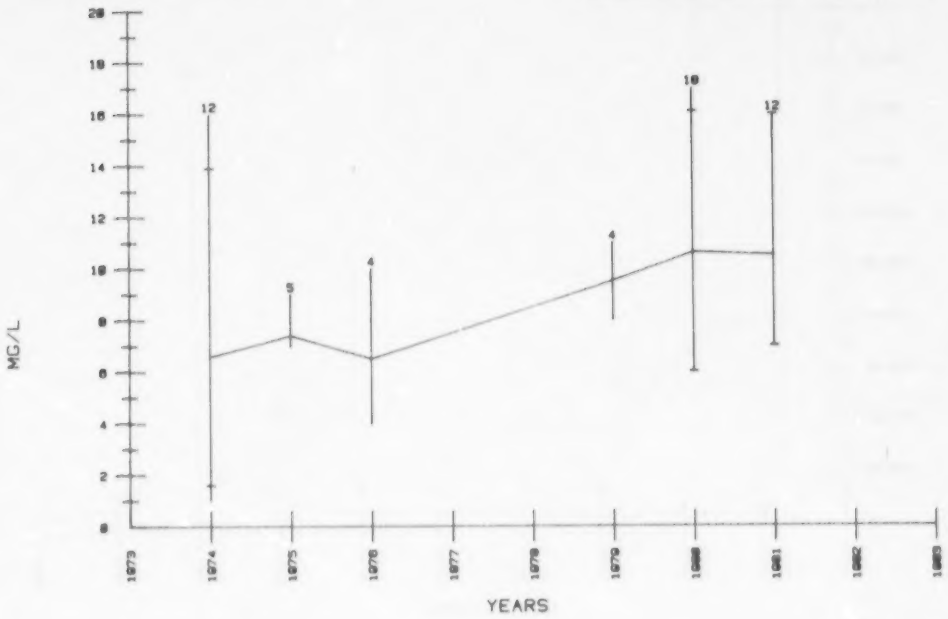
DEPTH: 5.1 TO 25 M



INORGANIC CARBON

110010401 ST. MARY LAKE NORTH END

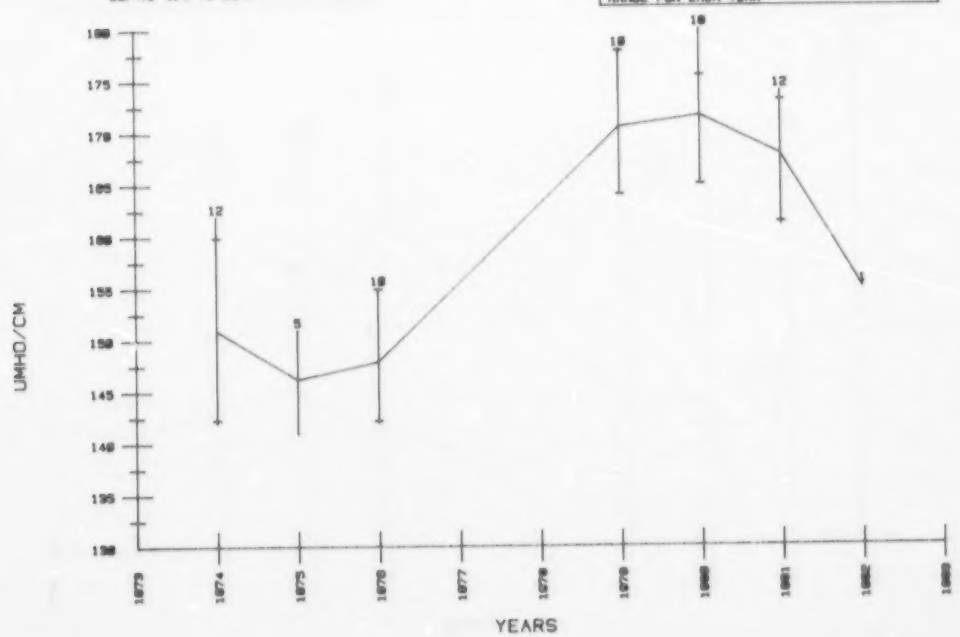
DEPTHS 5.1 TO 25 M



LAB SPECIFIC COND.

110010401 ST. MARY LAKE NORTH END

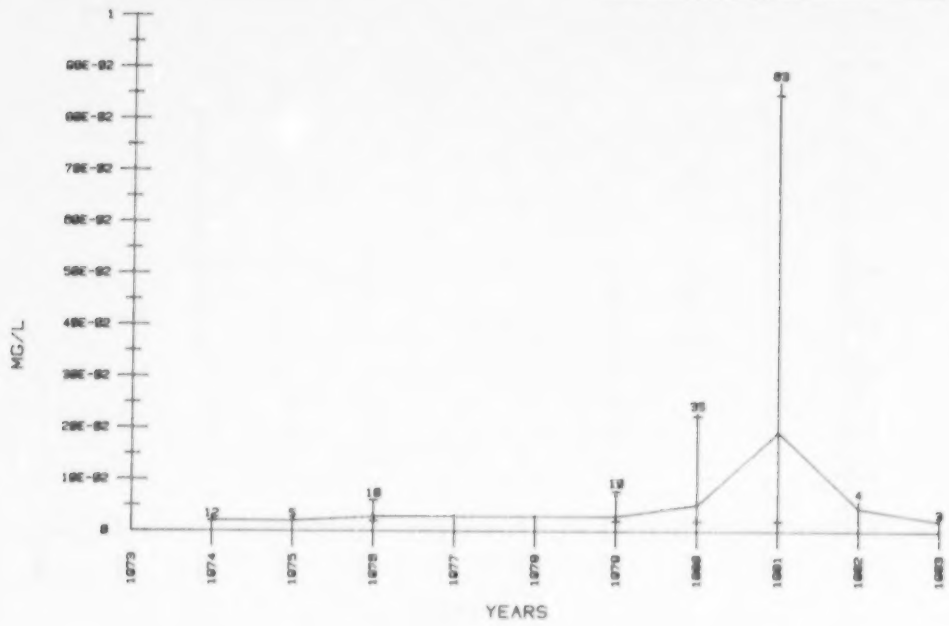
DEPTHS 5.1 TO 25 M



NITRATE + NITRITE

1100104: ST. MARY LAKE NORTH END

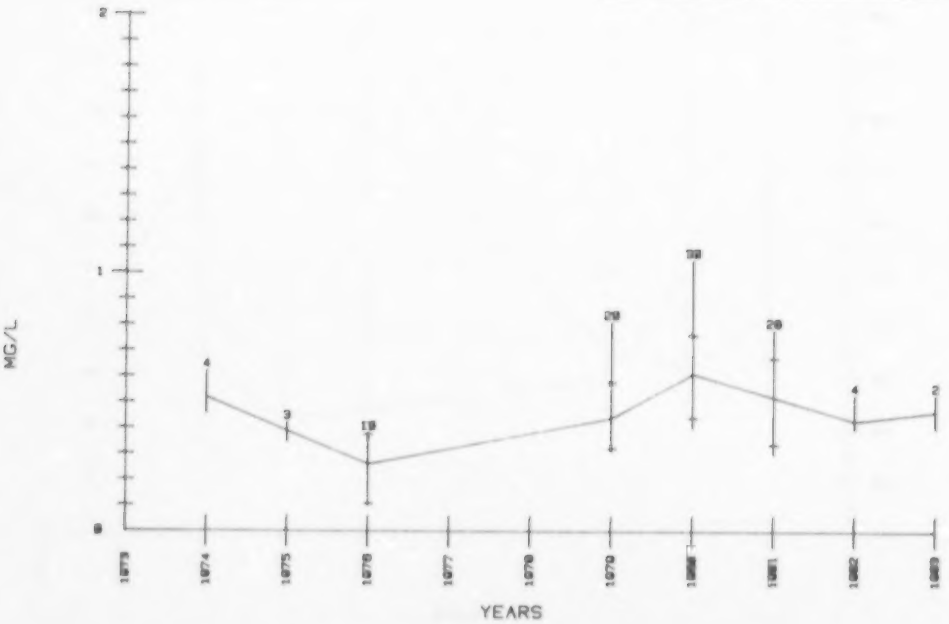
DEPTH: 5.1 TO 25 M



KJELDAHL NITROGEN

1100104: ST. MARY LAKE NORTH END

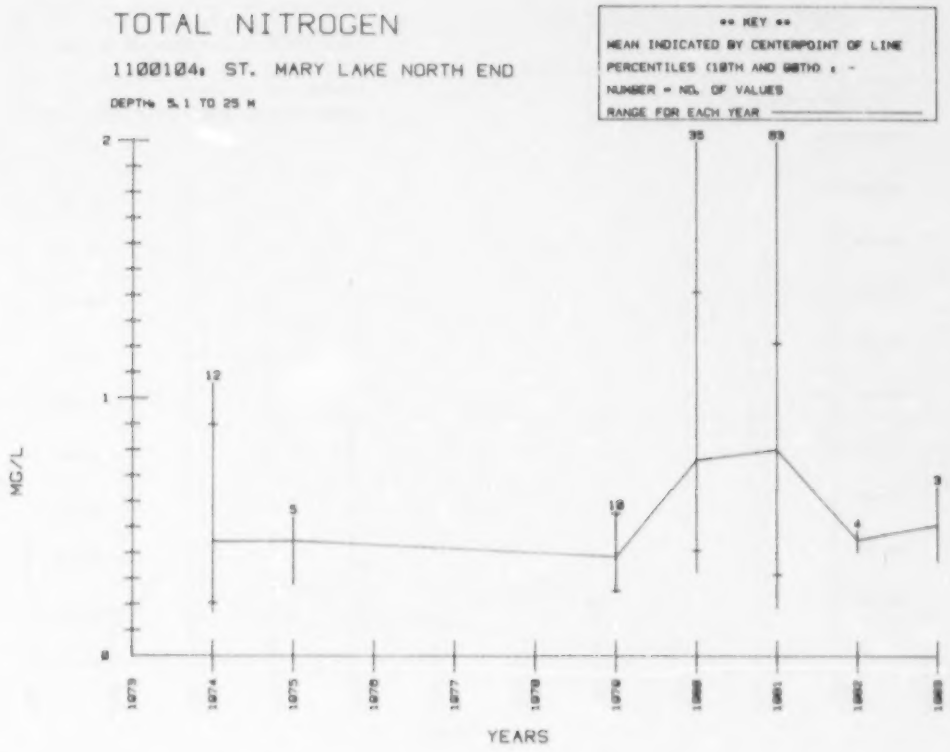
DEPTH: 0 TO 5 M



TOTAL NITROGEN

1100104: ST. MARY LAKE NORTH END

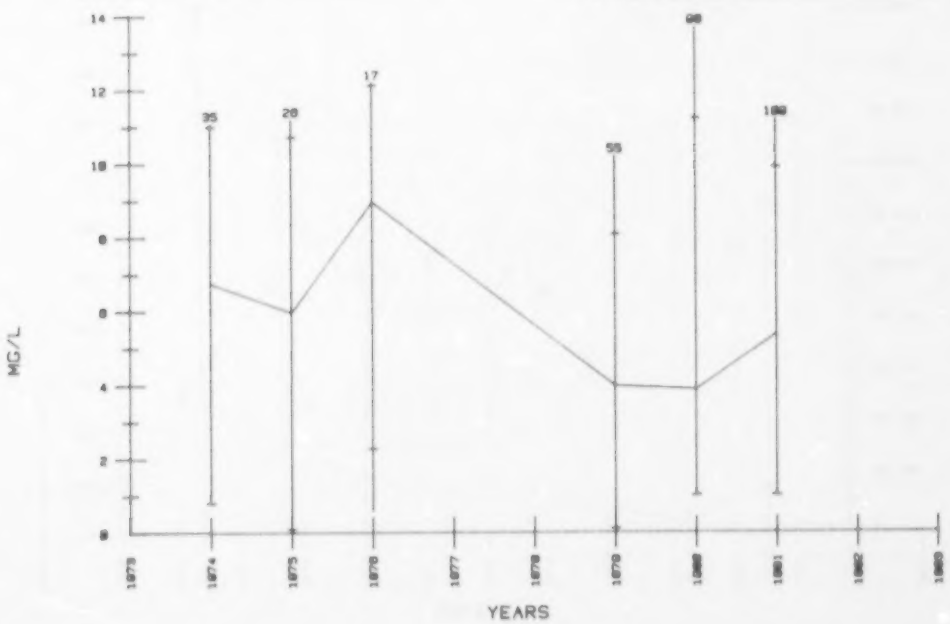
DEPTHs 5.1 TO 25 M



DISSOLVED OXYGEN

1100104: ST. MARY LAKE NORTH END

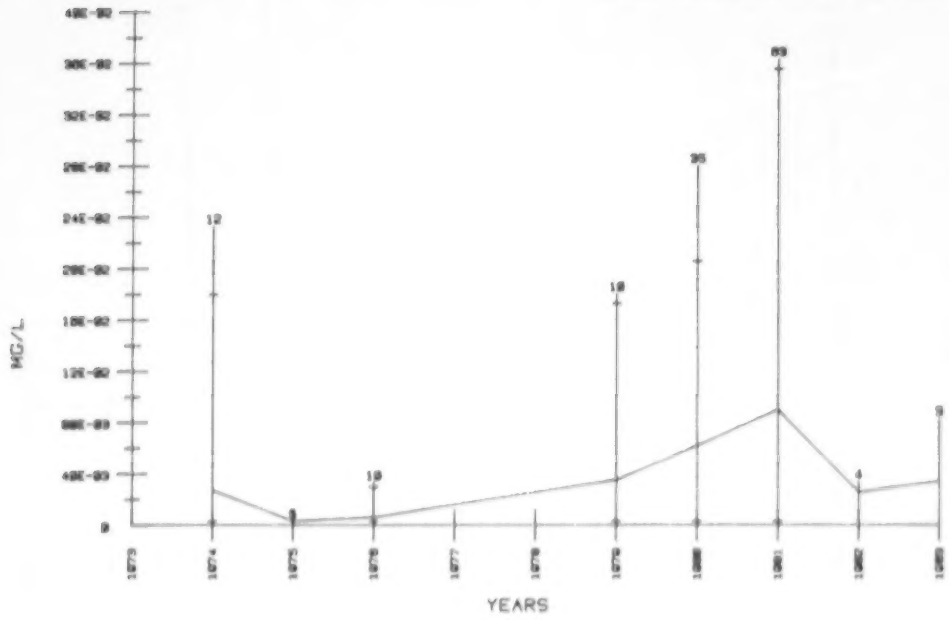
DEPTHs 5.1 TO 25 M



ORTHO PHOSPHATE

1100104: ST. MARY LAKE NORTH END

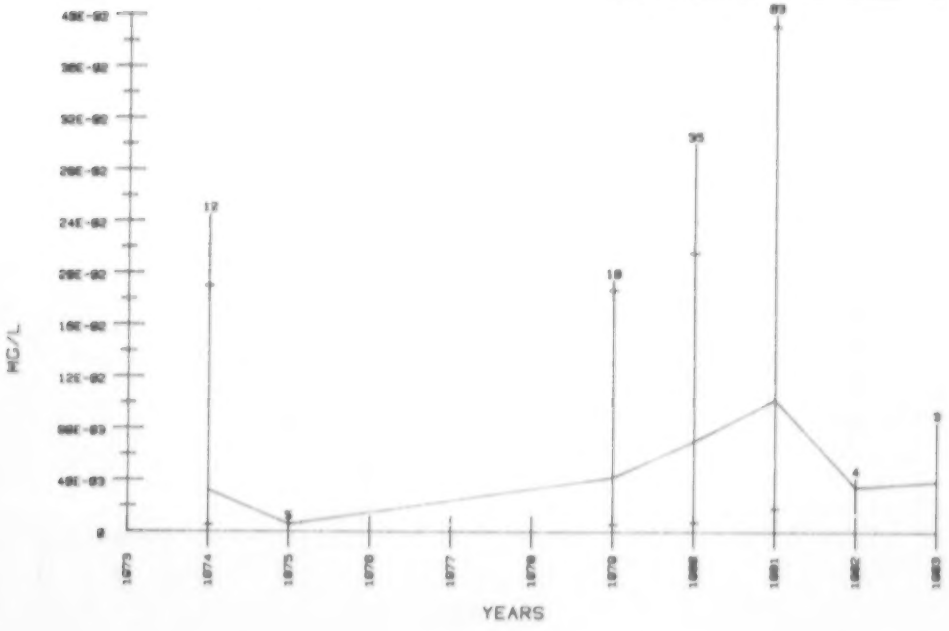
DEPTH: 5.1 TO 25 M



DISSOLVED PHOSPHATE

1100104: ST. MARY LAKE NORTH END

DEPTH: 5.1 TO 25 M

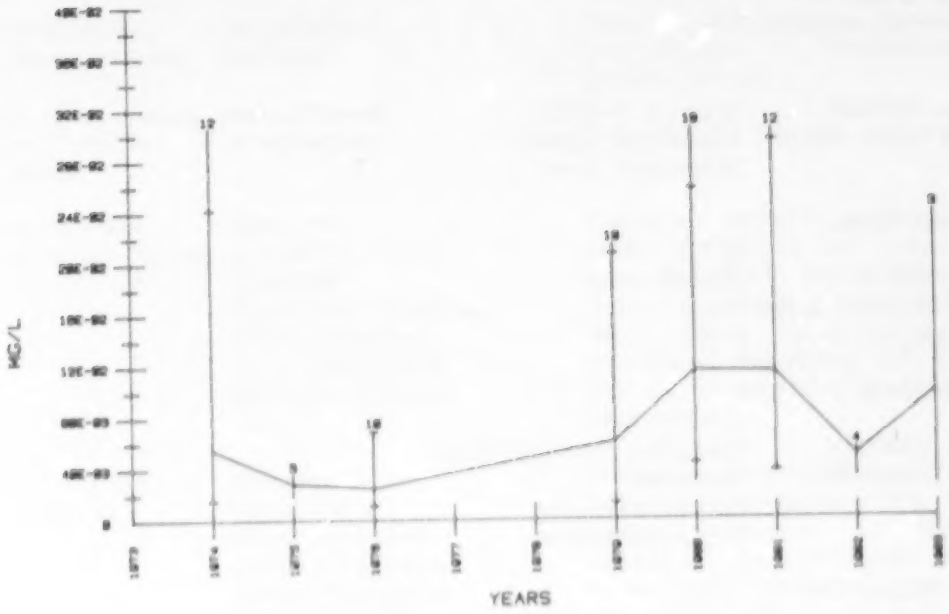


TOTAL PHOSPHATE

1100104: ST. MARY LAKE NORTH END

DEPTH: 5.1 TO 25 M

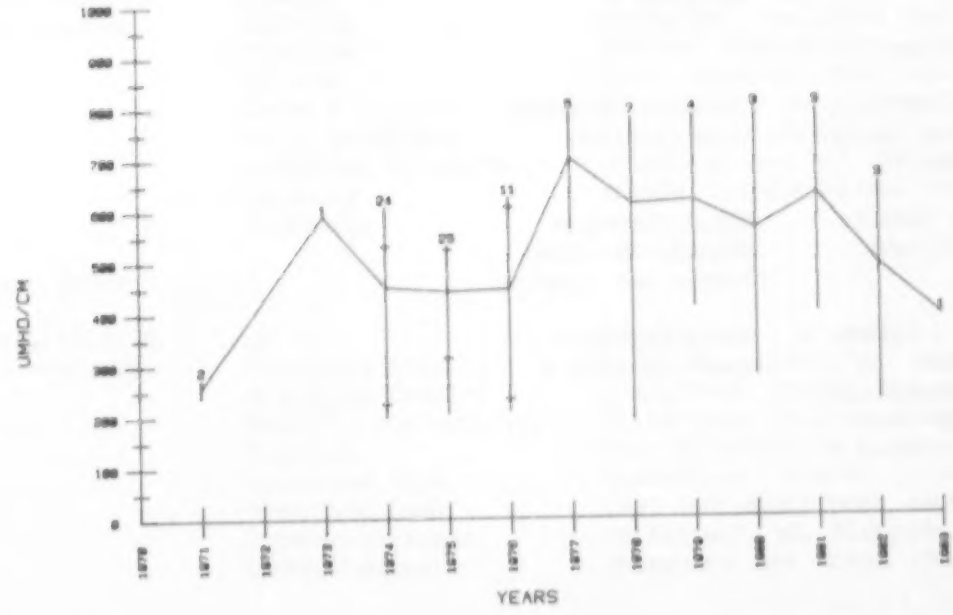
** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) = -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ———



LAB SPECIFIC COND.

0500101: WOLFE CR. D/S EAST TAIL DAM

** KEY **
MEAN INDICATED BY CENTERPOINT OF LINE
PERCENTILES (10TH AND 90TH) = -
NUMBER = NO. OF VALUES
RANGE FOR EACH YEAR ———



5.APPENDIX 1

REVIEW OF TRENDS IN WATER QUALITY IDENTIFIED IN 1978 REPORT

1.	Brandt's Creek, a tributary to Okanagan Lake		
	a. Site 0500009, near creek mouth	Organic Carbon Dissolved Copper Dissolved Iron	Insufficient recent data for trend evaluation.
2.	Coldstream Creek		
	a. Site 0500016, at Kirkland Drive Bridge	True Colour	" " "
3.	Columbia River		
	a. Site 0200003, at Birchbank	Specific Conductivity Hardness Ortho Phosphate Total Phosphate	" " "
4.	Cuisson Creek, a tributary to the Fraser River		
	a. Site 0600022, near Alexandria	Nitrate Filterable Residue Total Residue Sulphate	" " "
5.	Fraser River		
	a. Site 0600019, at the Quesnel Bridge	Kjeldahl Nitrogen Total Residue	" " "
	b. Site 0300117, at Lillooet	Total Chromium Organic Nitrogen Tannin and Lignins	" " "
	c. Site 0300004, at the Queensborough Bridge New Westminster	Total Chromium Fecal Coliforms	" " "

6. Kootenay River		
a. Site 0200020, at Canal Flats	Dissolved Potassium	Insufficient recent data for trend evaluation.
b. Site 0200048, at Skookumchuck	Phenolics Sulfate	Insufficient recent data for trend evaluation. (Phenolics to be re-evaluated).
c. Site 0200019, at Wasa	Ammonia	Included in present report.
d. Site 0200038, at Picture Valley	Ammonia Organic Carbon Fluoride Dissolved Phosphate Ortho Phosphate Total Phosphate Reactive Silica	Ammonia, organic carbon, fluoride, ortho phosphate and total phosphate are included in trends presently being reported. Insufficient recent data have been collected for dissolved phosphate and for reactive silica to permit a statistical trend evaluation.
e. Site 0200014, at Porthill	Ammonia Fluoride Dissolved Lead Ortho Phosphate Total Phosphate Total Residue Turbidity	Ammonia, fluoride, ortho phosphate and total phosphate are included in trends reported in this current report. Insufficient recent data have been collected for evaluation of dissolved lead and turbidity. Total residue is now considered a borderline trend. (i.e. possible real, but more data should be collected).
f. Site 0200013, at Creston	Ammonia Chloride Fluoride Nitrate Ortho Phosphate Total Phosphate Dissolved Potassium Sulphate Turbidity	Chloride, nitrate, dissolved potassium, sulphate and turbidity are now considered borderline trends (i.e. possibly real but additional data should be collected). Ammonia, fluoride, ortho phosphate and total phosphate are all included as real trends in this current report.
7. St. Mary River		
a. Site 0200135, at Wycliffe	pH Dissolved Arsenic Dissolved Cadmium Specific Conductivity Fluoride Dissolved Iron Dissolved Lead Organic Nitrogen Ortho Phosphate	Dissolved arsenic, dissolved cadmium, specific conductivity, dissolved iron, dissolved lead, filterable residue, total residue, and sulphate are now considered borderline trends (i.e. possibly real but additional data should be collected). pH, Fluoride, ortho phosphate and total phosphate have

Total Phosphate	little recent data, and also may have been influenced by a change in seasonal sampling patterns. Insufficient recent data have been collected for evaluation of organic nitrogen, dissolved potassium and reactive silica.
Dissolved Potassium	
Filterable Residue	
Total Residue	
Reactive Silica	
Sulphate	

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